COAL AGE

Vol. 3 NEW YORK, MAY 24, 1913 No. 21

THE coal industry has many members with axes to grind.

Some men are flatterers by constitution. They have no real conception of the true meaning of such words as wonderful, magnificent or marvelous. Due allowance must be made for all they say, and criticism of their effulgent praise should be governed by a generous recognition of their innocent and unassumed but unfortunate fault.

There are other people interested in some phase of coal mining, however, who are not flatterers by nature, and who sweeten their tongues with a motive always in view. They are like the fox who wanted the morsel of food which was held in the crow's bill. He expressed regret that the bird should have a poor voice coupled with such beautiful plumage. The crow, intending to refute the charge, released the prize, which the fox picked up, remarking: "Your voice is all right, but your wit is wanting."

The wisest man in ancient history once remarked: "He who flattereth his neighbor spreadeth a net for his feet." When a man commences an interview with the gift of a choice cigar, or hands out a fraternal grip, you can feel fairly certain there's to be a swapping of favors, in which transaction the other fellow intends to be sole referee as to the nature of both articles exchanged in the trade.

It's more decent to present your cigar or hand out your fraternal grip at the close of a business interview. Clubs, lodges and mining institutes are essential to good fellowship, rapid progress and business convenience; but the man who joins such an organization *simply and solely* to exploit his brother man is lacking in those principles which command success through personal merit or individual worth.

Here and there we can point our finger at some man high in the councils of coal men, who gained his undeserved success through influential friends or unworthy and shameful affiliations; however, there is no doubt but that the best pull is that of our own right arm. Only when it is weak do we need a lodge grip at the end of it.

Although we live in the most commercial age history has ever recorded, and are a part of the most commercial nation the sun ever shone on, there is still room for friendships not built on a money foundation with the single idea of promoting the transaction of business.

Personal pride, if nothing more, should compel us to refrain from insincere flattery to gain a point; and natural vanity in our own strength and ability to accomplish things should cause us to refuse an advantage coming only through the avenues of pull or social affiliations.

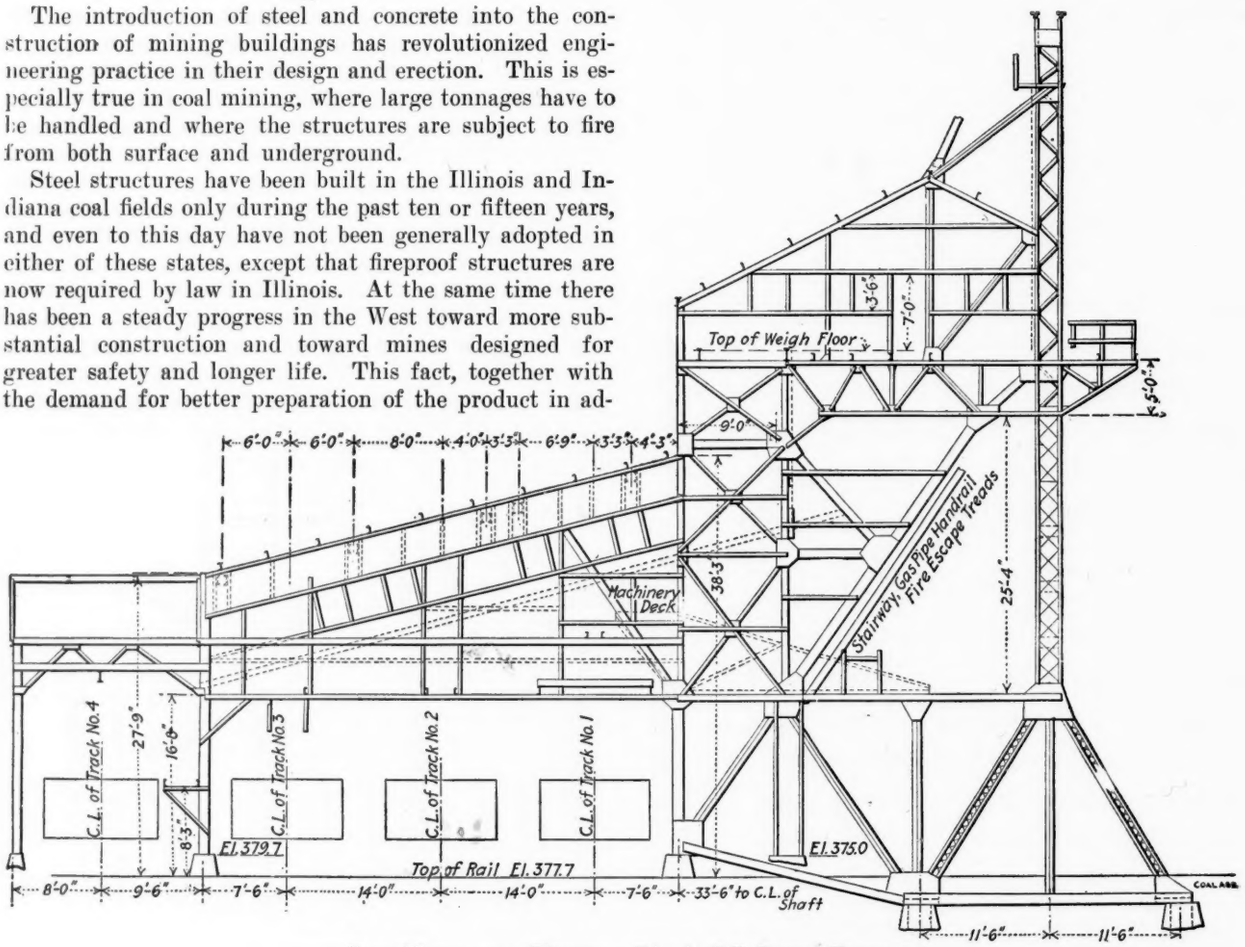
Modern Steel-Tipple Design

By John A. Garcia*

SYNOPSIS—The steps of evolution leading up to the introduction of an improved construction of headframe and screening plant are here delineated. This new design is only about one-half the weight of its predecessors and yet so rigid and firm that an independent screen-supporting framework is unnecessary.

The introduction of steel and concrete into the construction of mining buildings has revolutionized engineering practice in their design and erection. This is especially true in coal mining, where large tonnages have to be handled and where the structures are subject to fire from both surface and underground.

Steel structures have been built in the Illinois and Indiana coal fields only during the past ten or fifteen years, and even to this day have not been generally adopted in either of these states, except that fireproof structures are now required by law in Illinois. At the same time there has been a steady progress in the West toward more substantial construction and toward mines designed for greater safety and longer life. This fact, together with the demand for better preparation of the product in addition to the more recent requirement of law, has led to an interesting development in this line of engineering.



Side View of a Typical "A. & G." Steel Tipple

Importance of Shaft and Tipple

The keystone of a mining installation is the shaft and tipple. These are the connecting links between the underground workings and the commercial market, and it is natural that the best efforts of engineers have been devoted to securing permanence and safety from accident in these most important parts of a mining plant.

In the old days the shaft was put down in the cheapest possible manner, small, cramped and timber lined, and the tipple was placed immediately on the curbing or in some cases just outside of it. This structure usually consisted of six heavy, vertical timbers placed at the corners of the two hoisting compartments, braced laterally by batter braces and carrying the sheave wheel on cross timbers at the top. A heavy timber brace was then framed between the sheave deck and the engine foundations. The weighhouse was supported by similar bents placed between the tracks, and the screens were hung or supported underneath and covered by a loading shed.

When shaker screens began to come into use, it was found necessary to support them on an independent interior structure, as it proved difficult to produce and maintain a timber frame of sufficient rigidity to prevent the vibration of the screens from affecting the scales and seriously damaging the main building. On this account also, it became common practice to carry the screens on various systems of rollers, instead of hanging them as formerly, in order to avoid the great heights of the necessary overhead structure.

The first steel tipple followed almost exactly the lines of the accepted design in wood. At least six steel columns were placed on or adjacent to the curbing, the screens were carried on an independent structure and the batter braces connected as formerly, and the whole structure interwoven with a network of light angle bracing.

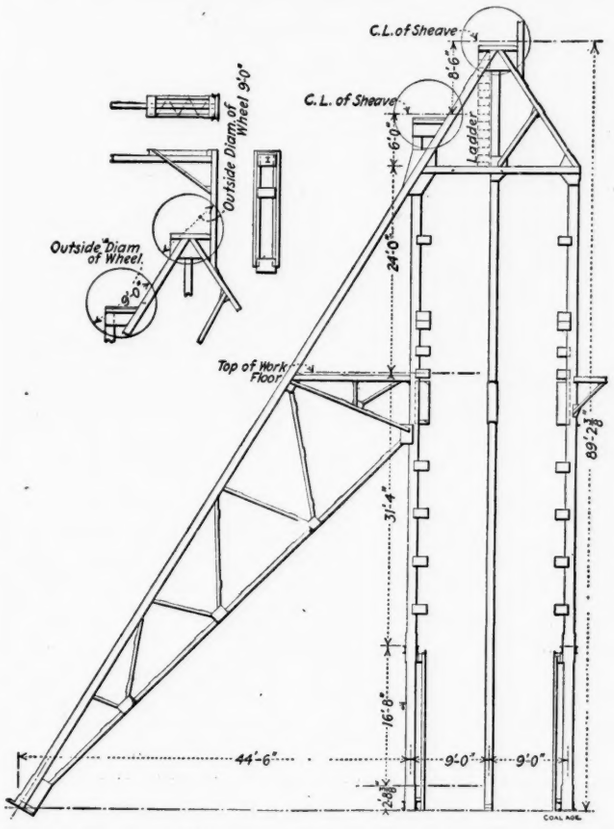
The actual working stresses in the tower were found

*Of Allen & Garcia Co., Chicago.

to be surprisingly small, and the required sections were made correspondingly light. The first designers did not realize that steel is an elastic material and that a structure of sufficient theoretical strength would lack entirely the rigidity necessary for satisfactory operation under the shock of hoisting and dumping and the constant vibration of the screens.

It is not surprising, therefore, that the first steel structures were distinctly less rigid and satisfactory than their wooden predecessors. They had just one advantage—they were fireproof. The freedom from shrinkage and rotting was offset by the rusting of the metal and the extreme liability of the light members to damage from accident.

Any damage to the shaft, any settlement around it, or fire in the curbing, had almost as destructive an effect



FRONT VIEW OF HOISTING TOWER, SHOWING SIMPLICITY OF CONSTRUCTION

on the tipple as if it had been built of wood, and the operators rightly began to wonder whether even the small increased cost of steel over wood was worth while.

THE FIRST SUPERIOR STEEL TIPPLE

The first step toward the construction of a steel tipple distinctly superior to wood was in the adoption of the "A-frame" design, in which the legs of the tower are carried onto firm ground well away from the shaft. Another improvement introduced about the same time consisted of crossing the tracks with a clear span and carrying the screens on a bridge so as to avoid the inconvenience and danger of columns located between the tracks.

The "A-frame" tipple, while a distinct improvement over previous designs, and greatly superior to the wooden structure in strength, permanence and rigidity, had some serious drawbacks. The guides had to be carried inside of a widely spreading tower by means of substantial horizontal frames, which, even if of sufficient strength, were particularly liable to damage and corrosion. Even at the best they added greatly to the cost of the structure. In this respect the old form of six-column tower, when the footings are carried a sufficient distance outside the shaft, still has an advantage over the "A-frame," although this advantage is entirely neutralized by the greater complexity of the structure.

In all these designs the independent screen structure was a uniform feature. The effect of the vibration of the screens was so little understood and so inadequately analyzed that none of the designers appeared to be brave enough to break away from the prevailing practice and plan a structure that should be stiff and strong and with the unavoidable vibration so localized that no damage could come to the structure or inconvenience to the operation of the scales.

In the meantime, there came a development in the direction of concrete or concrete-lined shafts. Such construction not only removes the danger of fire, but makes the shaft curbing, in most cases, the best and most substantial as well as the least expensive foundation on which to place the tower. The principal advantage of the "A-frame" structure was thus removed.

THE INTRODUCTION OF A NEW DESIGN

About two years ago, the Allen & Garcia Co., of Chicago, took up the problem of building a tipple over a concrete shaft and decided to place the main column members directly on the curbing. A system of construction was evolved and protected by patents, which seemed to be a distinct improvement over any previous construction. So simple was it that the only wonder is that it was not devised long before; in fact, the only reason that can be assigned is found in the gradual steps outlined above, from which the steel tipple was evolved.

Instead of putting uprights at the corners of the shaft, two main columns are placed in the middle of the curbing at either end, just back of the guides, these members themselves being carried directly by, or bracketed from, these columns. The center guides are also carried by a vertical column directly between them, it being hung from the main structure so as not to rest on the buntins and bracketed at several points so as to have ample lateral and longitudinal stiffness.

When adapted to an end-hoist tower, the sheaves are carried directly on an "A-frame" of the same width as the column, the forward leg of which is carried down to the ground in a line outside of the resultant of the cable stress. All columns are made of such width as will insure sufficient lateral rigidity when unsupported throughout their length, and also carry the journal bearings of the sheaves.

The main structure carrying the weighhouse and screens is built over the tracks at right angles to the hoisting frame and designed so as to give the greatest possible rigidity to the tower and to carry the shock of dumping directly to the ground.

With this tower of extreme rigidity, it is an easy matter to design a screen structure so stiff that the vibration of the shakers will have little or no effect upon it and the screens can then be hung on properly journaled, rigid hangers so as to operate with only a small part of the friction and wear incident to roller supports. The

eccentrics or other operating mechanism for the screens may then be supported on cross members, so that any vibration arising from them will be entirely absorbed before being communicated to the main structure.

The advantages of this construction are many. In the first place, the main tower is composed of three heavy and substantial members, which can be incased in concrete, so as to protect them entirely against accident or corrosion. Second, the weight and cost of the main tower, in spite of its great strength and rigidity, is scarcely half that of a properly designed "A-frame" tower. Third, the shaft is left entirely clear at the bottom of the tower, so that rails and other material can be easily loaded on the cages. Fourth, the foundations are cheapened and cut down in number. Furthermore, a screen house of sufficient stiffness can be rigidly connected to the main structure. Fifth, the guides are attached direct to the tower columns and form a stiff, rigid slide for the cages from shaft to dumping point; all at a less cost than the former style of construction.

In working out the details of this new type of structure, which has been christened "the A. & G. Patent Tipple," it became necessary to make a careful analysis of the action and operation of the screens. The first requirement is to design the shakers so that they will be as nearly balanced as possible under the varying conditions of load. This can usually be accomplished by making the upper section of the screen which receives the coal somewhat shorter and lighter than the lower section.

In studying the forces acting upon the screen through the driving rods, it became evident that it was possible to devise a much better operating mechanism than the time-honored eccentric, which is, as all engineers know, an inefficient and troublesome appliance for transmitting power. We have, therefore, substituted a bell-crank device, operated by driving rods from two large flywheels, which have been found to perfectly balance the two sides of the screen.

The power factor is thus made so constant that the motor or engine can be direct-connected to this shaft and as the whole mechanism is self-contained, the resulting vibration is small. The driving rods have brass journal bearings of ample size, arranged for thorough lubrication, and the ratio of lever arms is such that the forces are greatly reduced before reaching the driving rods and the flywheels.

While it is admitted that these changes are somewhat revolutionary, they are based on established mechanical principles, and are only a beginning of what can be done in transforming the old-style coal-mining plant into a simple, efficient and economical machine.

Adaptation to Timber-Lined Shafts

The next step was to adapt the "A. & G." construction to a timber-lined shaft, and this has proven to be unexpectedly easy. It is only necessary to carry the two main columns on a low "A-frame," or even on steel beams to any desired distance from the shaft curbing. Next comes the adaptation of this construction to the "side hoist," which may be required under certain conditions, and here it is also possible to use two main guide columns instead of the old-style six-column construction or the "A-frame," and to obtain the same advantages with a little economy.

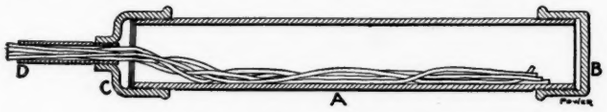
The perfect balancing of the screens and the accomplishment of proper separation for large tonnages especially, can be greatly facilitated by the introduction of an automatic feed hopper, which allows the coal to flow to the shakers at a uniform rate, thus avoiding the rush of imperfectly screened coal, so common when large amounts are dumped directly on the screen from the weigh-pan.

Space will not permit of the discussion in detail of these important questions, but the advantages of scientific designing are such that the sales department will find it increasingly difficult to market coal and show a yearly profit in competition with the operator who has taken advantage of the latest improvements in tipple construction and screening equipment.

Torch for Boiler-Inspection Work

The following description of a home-made torch, written by J. F. Mowat, of Joliet, Ill., appears in a recent issue of *Power*:

Some time ago there appeared in *Power* a description of a holder for a lamp to be used inside boilers. This ingenious arrangement brought to my mind a torch (by no means a new one) in use for the same purpose, which, possibly, does not require the care necessary with the lamp, as this torch burns equally well in any position.



Section of Home-Made Torch

One advantage of this torch, aside from the great convenience in inspecting boilers and in working in any dark restricted place, is the ease with which it may be made. Its great simplicity puts it within the reach of any handy man who has access to a hacksaw, a set of pipe dies, a vise and a few pipe fittings.

The illustration shows probably the most convenient size. A piece of 1¼-in. brass pipe *A* has a cap *B* on one end and a 1¼x⅜-in. reducing coupling *C* on the other. Into the coupling is screwed a ⅜-in. nipple *D*, about 2 in. long. A few strings of lamp wicking long enough to reach the bottom, complete the torch. Unscrew the coupling from the pipe, fill with kerosene oil, and it is ready for use.

British Coal Statistics

According to advance proof sheets of government statistics (the figures in which are subject to correction), the largest coal production of any county in England for the past year was for Yorkshire with 38,491,000 tons. Durham was second in production with 37,890,000 tons; Glamorgan was third, with 33,727,000 tons. Northumberland produced 13,381,000 tons.

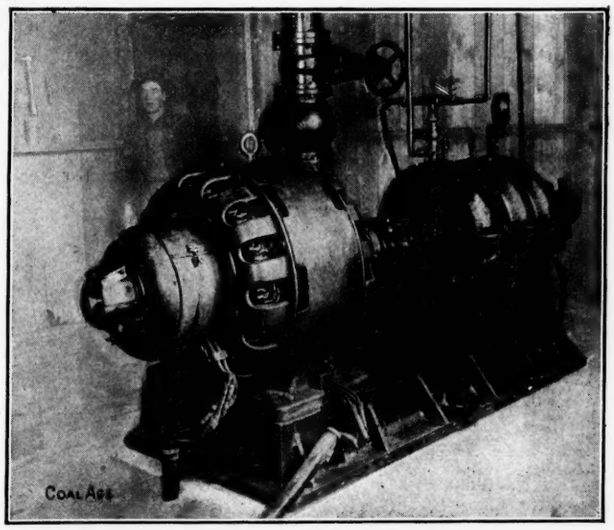
Each of these districts showed a decrease in yield from the previous year, due, of course, to the strike, but this falling off is less than might be expected when the duration of the stoppage is borne in mind.

The number of miners in Yorkshire slightly exceeds 161,700; Durham has 169,600 and Glamorgan has over 151,700 miners.

A Relay System of Pumps

The accompanying illustration shows an underground pump house of the Homestake Mining Co., at Lead, S. D. In this mine the arrangement of pumps is what might rightfully be termed a relay system, since the water is removed in a series of lifts.

The shaft is 1400 ft. deep and is supplied with pumping stations placed approximately 300 ft. apart, each station being equipped with two units, one of which is held constantly in reserve.



ONE OF THE UNITS AT ONE OF THE LOWER STATIONS

The amount of water handled by each pump is 1000 gal. per minute, and the head is approximately 325 ft. for the 1400-ft., 1100-ft., 800-ft. and 500-ft. levels, while this amount is reduced to 200 ft. for the pump placed nearest the surface. Each level is provided with a sump from which the respective pumps draw their supply.

Each of the four lower pump stations contains two Jeansville multi-stage centrifugal pumps of the double-suction type. These are direct-connected to 125-hp. Westinghouse, 3-phase, 60-cycle, 220-volt motors, operating at 1745 r.p.m., while the station at the 200-ft. level has pump units similar to the others in capacity, but with fewer stages and operating against a lower head.

Coal-Mine Accidents Report

(U. S. Bureau of Mines)

The coal-mine accidents occurring in the United States during the year 1912 have been compiled by the United States Bureau of Mines under the direction of Frederick W. Horton. The publication, which is now ready for distribution, is a résumé of the accidents from 1896 to 1912, inclusive, together with monthly statistics for the year 1912.

Mr. Horton, in reviewing the year, says: "During the calendar year 1912, there were 2360 men killed in and about the coal mines of the United States. Based on an output of 550,000,000 short tons of coal produced by 750,000 men, the death rate per 1000 employed was 3.15, and the number of men killed for every 1,000,000 tons of coal mined was 4.29. The number of men killed was the least since 1906; the death rate per 1000 employed was the smallest since 1899; the death rate per 1,000,000 tons of coal mined was the lowest, and the number of tons of coal produced in proportion to the number of men killed, the greatest on record. These facts offer indisputable evidence that conditions tending toward safety in coal mining are actually improving and that coal is now being mined with less danger to the miner than ever before.

"The general improvement in 1912, as compared with 1911, is shown by the following facts: In 1912 the number of men killed in the coal mines of the United States was 359 less than in 1911—2360 as compared with 2719—a decrease of 13.2 per cent., and this in spite of the fact that there were more men employed in the mines and more coal mined than in any previous year. The death rate per 1000 men employed in 1912, was 3.15 as against 3.73 in the previous year, a decrease of 15.5 per cent. During 1912, for every 1,000,000 tons of coal mined, 4.29 men were killed, as compared with 5.48 men in 1911, a decrease of 21.7 per cent. There were 233,000 tons of coal mined, for each man killed in 1912, as compared with 183,000 tons in 1911, an increase of 50,000 tons or 27.3 per cent.

"Although the improvement in 1912 was greater than in any previous year for which accurate statistics are available, partly due, perhaps, to the exceptionally mild weather during the last few months of the year, which decreased the likelihood of disastrous coal-dust explosions, there has been an annual improvement for a number of years, as indicated by the accompanying table:

NUMBER OF MEN KILLED IN AND ABOUT THE COAL MINES OF THE UNITED STATES, IN THE CALENDAR YEARS 1907 TO 1912, INCLUSIVE, WITH DEATH RATES

Year	Number Killed			Production per Death, Short tons
	Total	Per 1000 Employed	Per 1,000,000 Short Tons Mined	
1907	3197	4.88	6.93	144,000
1908	2449	3.64	6.05	165,000
1909	2668	4.00	5.79	173,000
1910	2840	3.92	5.66	177,000
1911	2719	3.73	5.48	183,000
1912	2360	3.15	4.29	233,000

"It will be noted from the foregoing table that the death rate per 1,000,000 tons of coal mined has decreased annually; that the production per death has increased each year since 1907, and that the death rate per 1000 men employed has steadily decreased during the last four years.

"This general improvement has been brought about by a combination of causes, the principal one of which has been more efficient and effective mine inspection on the part of the state mining departments and state mine inspectors throughout the country, supplemented by greater care on the part of both the operators and the miners. The investigative and educational work of the Bureau of Mines has kept both the operator and the miner alive to the various dangers connected with coal mining and has shown what precautions should be taken to avoid these dangers.

"Although there has been an annual improvement in mine-safety conditions since 1907, and a particularly notable one in 1912, a still greater decrease in the death rate can be effected. Whether or not such an improvement will be made in 1913 depends largely on the care exercised by the operators, superintendents, foremen, and all others in authority, and by the miners as well.

Copies of this report, Technical Paper 48, may be obtained by addressing the Director, Bureau of Mines, Washington, D. C.

"Safety First" the Slogan Cry

By J. W. Powell*

SYNOPSIS—The writer advocates the employment of a practical linguist at each mine to talk to the men and explain their work. He deprecates reliance on printed rules, and the use of the naked light. He points out that with telephones and refuge stations many lives could be saved.

The prevention of mine accidents has been the foremost thought of all conscientious mine owners and managers from the beginning of the industry to the present day; and prevention of accidents will continue to be the first aim of every careful official charged with the responsibilities of coal mines for all time to come. With this idea in view I offer the following suggestions.

A Mining Instructor in All Languages Represented.

(1) Thirty-five years ago, the mine workers in Anglo-Saxon America were mainly of English, Welsh, Scotch, Irish, French, Belgium or German extraction, while today the major portion of the laborers employed in our mines are emigrants from central and southern Europe, who are very much inferior to their predecessors.

These men are foreign to our customs, do not understand our language and the majority never saw a coal mine before coming to this continent and securing employment therein, and a large percentage of our accidents today can be attributed to these facts.

I would suggest that in every mine employing this class of labor an official who thoroughly understands the language of the men employed be appointed by the management, this official to confine his whole attention to the instruction of these men in the different methods of working, the safe handling of explosives, drilling and tamping of holes, undermining of coal, placing of timbers, etc., and all the various things having reference to their own safety and the safety of their fellowmen and of the property in general. It would not be necessary for this official to be certificated because he would be acting under the direct supervision of the certificated mine officials. Nevertheless he should be a man chosen by the management after careful consideration as to his practical knowledge, carefulness and force of character so that he might thus be enabled to command the respect of the men under his instructions.

Danger Signals and Illustrations

(2) Danger signals should be placed at several conspicuous points throughout the mine; these should be flashed by electricity where the mines are non-gaseous or painted in large letters in the different languages if gas is encountered in the mine. In addition to these there should be large finger boards pointing the direction to the surface and placed at different points throughout the mine where men are liable to become confused.

At the entrance to the workings above ground, in addition to the rules and regulations required by law, large pictures or lithographs should be tacked up, these pictures depicting the different accidents which frequently occur in the daily operation of mines, due to the carelessness of the men. For example, a miner could be shown preparing a charge of powder with a naked light on his head, undermining coal and neglecting to use sprags, working under a dangerous roof and not placing timbers, tampering with a safety lamp or using a match to light his pipe in a gaseous mine.

That day is long past when extended, heavy matter written or printed was read with avidity. Today we must reckon with the hustle which is the spirit of the age. Business and like institutions no longer call attention to their products by the use of many words. Instead of that they grip the spirit or central idea that such words would convey and depict that leading thought so that it may be apprehended at a *single glance* and leave a lasting impression on the memory.

To attempt to interest the men in safety by a system of "rules and regulations," printed in small type and carefully framed, will in my estimation fall far short of accomplishing the desired end since men by reason of deficiency in education, dullness of comprehension, or lack of knowledge of the language may not be able to understand the words at all, and those who can, have neither the time nor the inclination to do so.

The Naked Light and Its Many Crimes

(3) Naked lights should be prohibited by law in all coal mines. The lives which have been sacrificed upon the altar of the naked light have been legion, if we add to the losses due to insufficiently diluted products of combustion, the disastrous fires which have been caused by open lights and also the various other accidents which can be attributed to them. Sparks from lights have ignited kegs of powder, and boxes of detonators have been exploded by the same cause.

I would suggest the use of some form of inclosed light. Electric lamps seem to be giving satisfaction to some of the companies which have installed them. Again, nothing but the most approved type of safety lamp should be used in a mine showing the least trace of explosive gas; the use of mixed lights as is practiced today in some mines should be prohibited by law.

Telephones and Rescue Stations

(4) Telephones should be established in every mine connecting the inside workings with the office on the surface, such telephones should be placed at different points throughout the mine so as to be easily accessible in case of accident. The lines should be securely laid in conduits underneath the tracks in such a way as not to be liable to injury in case of derailment of cars or an explosion.

(5) Refuge stations should be required by law in all coal mines where the number of men employed under ground exceeds 50, so that in case of an explosion of gas, or a mine fire or any serious accident which cuts off access to the surface, the men may find refuge within its walls.

These stations should be excavated in the solid coal and surrounded by large pillars. The entrances should be through long, narrow necks which are provided with 3 or 4 sets of massive iron doors constructed in such a manner as to be explosion proof. In heavy pitching

*Mine superintendent, Mount Carbon Colliery Co., Coalmont, B. C.

seams these chambers could be excavated in solid rock on the sides of the entries.

Equipment of Refuge Chambers

To be effective such stations should be provided for each district in the mine. These stations should be connected to the surface by a compressed-air line either carried through boreholes from the surface, or through indestructible conduits along the headings. These conduits should be constructed in such a manner as to be proof against fire and explosion. Each station should be provided with a complete telephone system connected with the office on the surface, also with first-aid cabinets, stretchers, medicine chests, water for drinking and supplies of concentrated foods in dampproof cases for use by men who might be cut off from the surface for an indefinite time.

Electric lamps and an adequate supply of safety lamps of the Wolf type should be provided, with material for recharging the same, also rescue apparatus, compressed-oxygen cylinders and pulmotors for resuscitating men overcome by deadly gases. Trained men should be constantly in charge of such stations so that in case of accident they could sally forth from such places and work in conjunction with the rescue parties from the surface.

They would be far more effective in my estimation, as they wouid be close to the seat of the disaster, and men would be rescued and resuscitated, and restored to anxiously awaiting wives, children and friends on the surface. These men would be irretrievably lost if they had to remain in the fouled atmosphere of the mine until relief came from the outside.

There would also be a great saving of human lives among the rescuers, numbers of whom are killed in modern disasters. With independent means, by which the entombed could take care of themselves, it would not be necessary for the rescuers to act with the same haste and intrepidity, for the telephone system would apprise them of the conditions in the underground workings of the mine.

How Previous Mine Disasters Testify to the Value of Refuge Stations

Let us take a retrospective view of some of the disasters which have occurred in our mines and we will be enabled to imagine what a blessing such stations would have been to many of our poor unfortunate brothers entrapped. The Courrières mine disaster in France was the greatest in mining history. There is evidence that hundreds of the men in this mine lived for days after the explosion, some of them for two weeks, devouring the bark of mine timber and the putrid flesh of horses.

At the Monongah disaster, Dec. 6, 1907, 361 lives were lost, quite a number of which could have been saved, as was ascertained by the conditions. Some of the men were found with their heads in the ditch seeking a breath of fresh air. At the Primero explosion, Jan. 31, 1910, 11 men must have lived for hours after the disaster, for one man who was found with them was finally resuscitated. At the Fernie disaster in British Columbia, 58 men lived for 48 hours but were finally overcome by the gas which leaked through the stoppings.

A Refuge Station Would Have Saved 26 Men at Bellevue

At the Bellevue explosion in Alberta, Dec. 9, 1910, 31 were killed, including one of the rescue party. This number would have been reduced to five if there had been a refuge station in the working district of this mine. I found 21 men lying along the ditch at a compressed-air charging station near chute 84, seeking fresh air. All these men could surely have been saved, as there were 8 men rescued on the same entry 10 hr. later and these were over 2000 ft. further inby. Had the other men retreated to the face the death list would have been greatly reduced.

At the mine fire at Cherry, Ill., Nov. 13, 1909, 256 lives were lost. Written messages, several very pathetic, addressed to their families, were found with the bodies. One message showed that some of the men were conscious for 48 hr. after the fire started. Several paddle fans had been constructed from parts of drilling machinery and pieces of board. These were made, as indicated by one message, with the forlorn hope of stirring up the air while making an attempt to reach the shafts. There were, however, 21 men who saved their lives in this disaster by erecting a barricade across one of the entries, building it with powder cans, stones and mud. These men were rescued seven days after the disaster occurred.

At Delagua, Colo., Nov. 8, 1910, there was a fire and an explosion in which 33 men were killed by noxious gases and 46 by the violence of the explosion. Quite a large percentage could have been saved had rescue chambers been provided. Four men were rescued seven or eight hours after the explosion. They were found behind a brattice which they had erected to keep back the afterdamp.

In the Price-Pancoast mine fire in Pennsylvania, Apr. 7, 1911, 73 lives were lost; all of which possibly might have been saved if sufficient refuge stations had been provided.

Industrial Provisions Have Lagged behind Civic Safeguards

We have our large standing armies prepared for war in times of peace. We have our life-saving stations for the protection of lives along our seashores and at our summer resorts. We have our fire brigades in our cities ever on the alert for the protection of lives and property. In our coal mines comparatively nothing has been done in this direction for the preservation of the lives of those who work in perpetual danger and who may at any moment be imprisoned deep down in the bowels of the earth. Germany and Austria are taking up the matter of providing safety stations for the protection of their miners, and I think it is high time that their examples be followed.

(6) It is essential for the safety of our mines that there should be efficient discipline, and in order to attain this end the management of the mines should be permanent. We do not appear as yet to have learned the value of efficient, permanent management as a factor of safety and economy. Management, as a general rule, cannot be efficient unless it is continuous.

To operate mines safely and successfully there should be a mutual feeling of interest between all officials and their employers, a feeling that their association together is of a lasting character. I do not think it good practice in the interest of safety and economy to make a habit of changing officials as seems to be the policy of some companies. As a general rule accidents occur and mines are destroyed where the mine officials are continually coming and going.

The Dangers in the Mine Must Be Met by Discipline

The mine managers and subordinate officials who are successful in securing safety in a mine are men who are not afraid to stand upon their conviction and insist upon the directorate of the company furnishing them with the necessary wherewithal to protect the men under their supervision, even if it does raise the cost per ton a cent or two. If they do not have the backbone to do this, they should at least be just to their fellow men and hand in their resignations, as they are unfit for the positions with which they have been entrusted.

If they find a man violating the rules and regulations laid down for the common safety, they should not discharge him. He should be turned over to the stern hand of the law. There is no punishment which brings results as quickly as that administered by the courts. You can reprimand a man or you may discharge him and he will forget it in a short time, but arrest him and you are assured that he will not be in a hurry thereafter to violate the mining law in your mine or in that of any other company.

Meet Your Accidents Midway

When you discharge him he simply leaves you and goes to some other place and secures employment and in all probability does the same thing over again. This possibly results not only in the loss of his own life but in that of many others. All subordinate officials should be given a complete understanding of everything required for the safety of the mine and a responsibility equal to their ability for the preservation of the safety of the mines and the lives of the workmen. If any member of the official family is found to be lax in his duties or is becoming indifferent in his work, he should be immediately dealt with accordingly, as the laggard is a very dangerous official in any mine.

The philosopher who said "Forethought will often save much afterthought" expressed a great truth. Superintendents and mine managers should consider, with the officials underground and above ground, the quickest and safest method to enter the mine in case of an explosion or fire. They should have all their plans outlined and discussed and all the officials should be acquainted with the result of the deliberations.

They should imagine a fire occurring in different parts of the mine and plan their action in such cases. Remembering that an explosion may occur in certain parts of the workings or may involve all the headings and destroy their system of ventilation, they should discuss the same carefully and decide upon plans for the different cases. It is far better to prepare plans and modify them as necessity points out than to meet the catastrophe without them.

❖ ❖

Handy Apparatus for Testing Mine Air

Special Correspondence

SYNOPSIS—The author describes two apparatus, one for the measuring of methane and the other for determining all the impurities in mine air. A knowledge of chemistry is not needed to manipulate the apparatus. Even the gas ignition is automatic, taking place only when the mercury has cut off the required body of air.

❖

The rules and regulations of the British Coal Mines Act of 1911, which came into force on Jan. 1 of this year, provide, that a place shall not be deemed to be in a fit state for working or passing therein if the air contains either less than 19 per cent. of oxygen or more than 1¼ per cent. of carbon dioxide and an intake airway shall not be deemed to be kept normally free from inflammable gas if the average percentage of methane found in six samples of air taken by an inspector in the air current in that airway at intervals of not less than a fortnight, exceeds ¼ per cent.

No Open Lights in 0.5 per Cent. of Gas; No Electricity in 1.25 per Cent.

Moreover, no lamp or light other than a locked safety lamp can be carried or used in any seam where the air current in the return airway from any ventilating district in the seam is found normally to contain more than ½ per cent. of inflammable gas, and further provisions are that if at any time, in any place in the mine, the percentage of inflammable gas in the general body of the air in that place is found to exceed 1¼ per cent., the electric current shall be at once cut off all cables. This, of course, does not apply to telephone or signal wires and instruments, so long as safe conditions for the use of such wires are provided.

In order to provide for such tests, Leonard Levy, of the engineering firm of Alexander Wright & Co., Ltd., of Westminister, has developed the instruments shown in the accompanying figures. The first is for the estimation of methane only.

The measuring tube A is surrounded by a water jacket and its narrow stem is graduated so that the percentage of methane can be read directly. It is closed at the top by a cock *B* containing an "L" shaped bore so arranged that it is impossible to put the oxidation tube *C* into direct communication with the atmosphere. The plug of the cock has a screw washer fixed on the back so that it cannot be accidentally withdrawn from the barrel.

Automatic Ignition of Gas

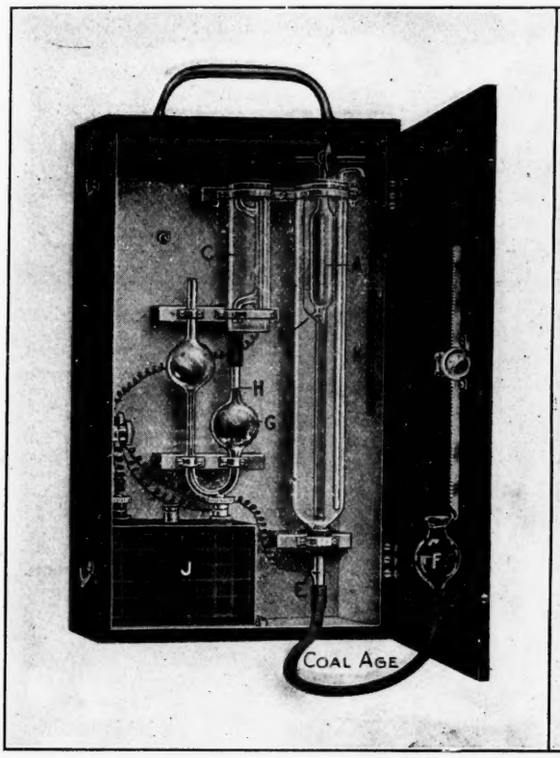
A new type of oxidation tube, *C*, has been devised by Dr. Levy. It consists of a fine quartz capillary tube through which a platinum wire runs axially. This wire is heated to whiteness by a current derived from the small storage cell *J*. The expansion of the wire on heating is taken up by a spring to which one end of the wire is attached. This oxidation tube is entirely surrounded by a water jacket.

The current passes through the platinum wire when the mercury in the measuring tube reaches the fused-in platinum contact *D*. Connection to the mercury is made through the fused-in contact at *E*. It is thus evident that the current only passes when the reservoir *F* is raised to drive the gas through the tube *C* and thus the oper-

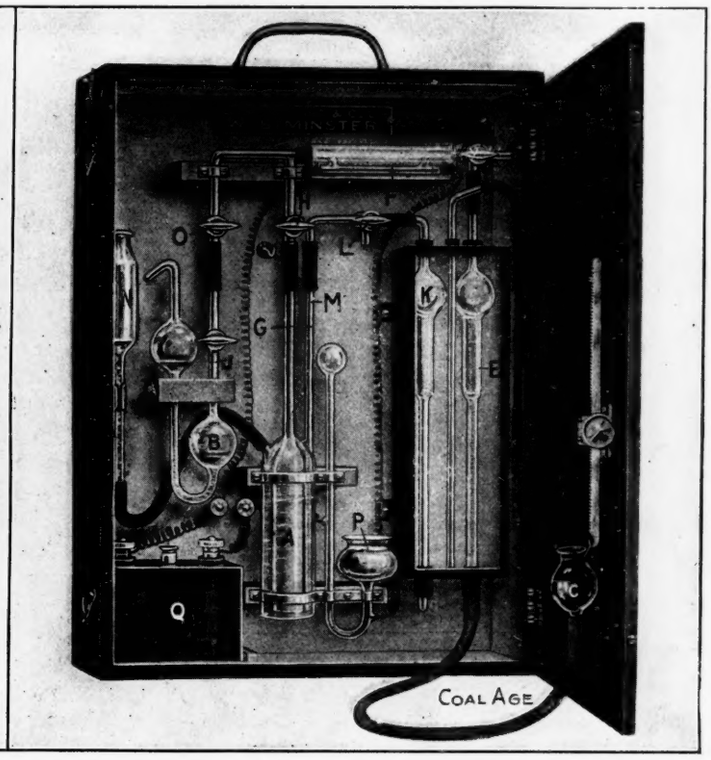
ation of passing the gas over the wire, automatically switches on the current.

During its passage through the quartz-platinum tube the methane present, no matter how small may be the percentage, is completely oxidized to carbon dioxide and water. The resultant contraction is equal to twice the volume of methane present and is observed on the fine stem of the measuring tube. The graduations at 0.25 per cent., 0.5 per cent. and 1.25 per cent., the three limits specified in the Act, are marked in red.

Two passages of the gas through the quartz-platinum tube are sufficient and an estimation can readily be effected in two minutes. An accuracy of 0.005 per cent. is readily attainable on the assumption than no combustible gases other than methane are present.



Apparatus for Determining Methane Only



Device Makes a Complete Analysis of Mine Air

Can Be Operated by Anyone Who Can Read a Scale

No caustic liquids or chemicals are employed and the necessary manipulation merely consists of drawing in a sample of the mine air by raising and lowering the reservoir *F*, and then effecting the estimation by turning the cock *B* to communicate with *C* and raising and lowering *F* twice. No knowledge of chemistry or gas analysis is required and the percentage of methane is read off directly from the position of the mercury in the graduated stem of the measuring tube.

As the make and break of the electrical circuit are entirely inclosed in the tube *A* which is surrounded by a water jacket there is no danger of any explosion being caused by the spark at the contact. The apparatus is very small and compact. The external dimensions of the base are 13½x8x3 in. and the total weight ready for use is 8 lb. A tripod is sometimes used for supporting the apparatus.

The main principles of the other apparatus which is designed for the complete examination of mine air are exactly the same as in the one first described and it contains precisely the same provisions for rapidity, accuracy and safety in use. However, in addition to affording a method for accurately estimating the methane, means are provided for the precise determination of carbon dioxide and oxygen.

A measuring tube *E* is provided into which the sample of mine air is drawn by raising and lowering the reservoir *C*. The gas is first passed into the vessel *A* which contains potash. The carbon dioxide is removed here and on drawing the gas back into the measuring tube, the percentage of carbon dioxide is observed directly on the finely divided stem. The wire in the quartz capillary tube *F* is now heated to whiteness by passing the current, supplied from a two-volt storage cell *Q*.

The circuit is completed by pressing on the leather top of the safety mercury switch *P*. This causes the mercury to rise in the tube and completes the circuit. As the make and break of this current are entirely inclosed, there is no danger of firing the atmosphere and should the apparatus be accidentally dropped, the circuit is immediately broken. The mine air is again passed through the tube *F* into the vessel *A* by raising the reservoir *C* and drawn back into the measuring tube *E* by lowering the reservoir *C*.

The percentage of methane is thus obtained by an observation of the level of the mercury in the tube *E*. The mine air is then passed into the vessel *B* where the oxygen is removed and its percentage determined by an observation of the position of the mercury when the air is passed back into the tube *E*. The complete analysis is thus effected by a simple manipulation. The apparatus requires no previous knowledge of chemistry.

The Superior Coal Co., Wyo.

By W. D. Brennan*

The operation of the Superior Coal Co. is located among the hills of southwestern Wyoming at an altitude of 7000 ft. It is at the terminal of an eight-mile branch line, running north from Thayer Junction on the Union Pacific R.R.

The growth and advancement of this camp since its opening, less than seven years ago, has been a marvel of Western industrial development. It has now a population of about 3000 people and a daily production of 5000 tons. The coal is semi-bituminous and among the best for steam purposes, mined in the Rockies.

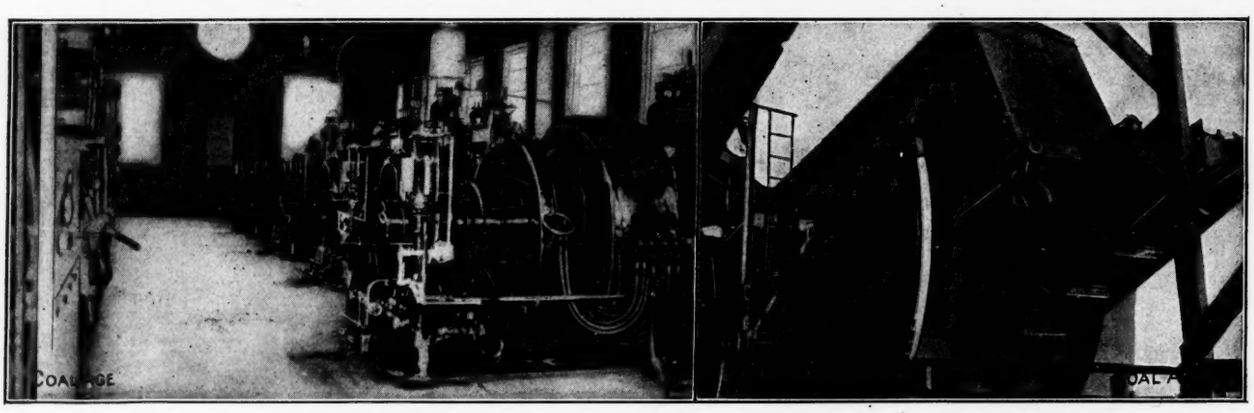
There are five mines in operation at present, working on three different seams, and two more are under development. The camp is electrically operated throughout, the coal being mined, drilled and hauled by electric machinery.

The main power-plant is centrally located, its equipment consisting of four 300-hp., and six 250-hp. marine boilers, and four 300-kw., 2300-volt, 60-cycle, 1800-r.p.m. turbo-alternators and two 300-kw., 250-volt direct-current turbines. Apart from this is an auxiliary gas producer plant, equipped with a No. 8 Wood Producer, an 18x24-in, tandem gas-engine, and a 150-kw. generator. The latter has proven quite successful, generating 1000 to 1100 kw.-hr. in an eight-hour run.

The "E" Mine, is a two-compartment shaft, equipped with a steel headframe, a double-drum, 200-hp. hoist, hung directly over the shaft, and self-dumping cages. There is also a steel cradle box-car loader, capable of handling 50-ton loads at an angle of 50 deg. Mine-run and lump may be loaded on two tracks at the tipple, or conveyed by belt to the adjacent rescreening bins having underneath and side chutes for loading either open or box-cars.

The modern tendency toward permanent construction is as prominently in evidence in the Rocky Mountain states as in East. Some typical examples of this are shown in the accompanying photos, the large central stack for the power plant, the steel headframe and the liberal use made of concrete. It is proposed to work out an extensive acreage with this plant, which partially accounts for the thorough equipment of the operation.

A Detailed and General View of the Surface Equipment at the "E" Mine



Interior View of the Turbo-Generator House and the Cradle Box-Car Loader

*General superintendent, Superior Coal Co., Cheyenne, Wyo.

Acme Plant in Pennsylvania

The Acme Coal Mining Co.'s plant at Rimersburg, Clarion County, Penn., while not of such large capacity as compared with some other electrically operated mines, it is a particularly interesting one. Before the installation of the new electrical machinery and other improvements this mine had an output of approximately 700 tons of coal per day, but it is expected that this will be doubled within the year.

A small direct-current plant was formerly the only power used, but when the new mine was opened some distance away, it was decided to put in an alternating-current machine so that current could be economically transmitted.

The selection of an alternating current was decided upon as being best adapted to the conditions to be met.

The present site of the plant is about in the center of distribution for the mines to be supplied, and accordingly the new installation was located there. This meant that it was only necessary to remove the old direct-current generating equipment and install the new machinery. Being centrally located, accessible to water and fuel, it will be possible to supply other mines in the future, should there be occasion for such.

The Electrical Equipment

It is intended to electrify what is known as the Shannon mine and preparations have already been made for this work. Energy will be sent from this plant to a substation, located near the mine, from which direct current will be delivered to the pumps and locomotives. The generating equipment in the main power plant consists of one 400-kv.-a., 60-cycle, three-phase, 2400-volt Westinghouse alternator, direct connected to a 700-hp. Ball engine, and a three-panel marble switchboard for control of same. A voltage regulator maintains a constant voltage at the plant.

The alternating current generated here is transmitted a distance of about three miles to a substation where it is changed to direct current for operation of the mine machinery which consists of three locomotives, pumps, lights, etc. The change to direct current is affected by means of a three-bearing Westinghouse motor-generator set consisting of a 300-kw. compound-wound, 275-volt direct-current generator direct connected to and mounted on a common iron base with a 450-hp., 60-cycle, 2200-volt, three-phase, self-starting synchronous motor. The speed of the set is 900 r.p.m. The motor is started by means of a three-phase auto transformer, thus obviating the trouble of synchronizing.

The direct current is carried into the mine by means of lead-covered cables through a bore hole located near the substation, thus rendering the liability to interruption on account of grounds very remote. The lead sheathing also materially increases the safety of employees, which is always a point of particular importance, especially in mine operations. The distance from the top of the seam to the surface at this point is 246 ft. From the bottom of the bore hole, the current is distributed to the different portions of the mine by independent circuits so that in case of any trouble on one of these, no portion of the mine will be affected other than that fed by the circuit on which the trouble has occurred.

With the completion of the electric equipment, it is said that the Acme Coal Mining Co. will have expended a total of $100,000 within a year on the plants in the neighborhood of Rimersburg. All of the improvements and additional equipment were installed in the best manner possible and are of a permanent nature. The entire work has been carried on under the direct supervision of W. G. Strachan, superintendent, and the electrical work was designed and installed under the direction of the company's chief electrician, J. A. Shaw.

The entire electrical equipment of the main and substation was furnished complete by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pennsylvania.

Two Westinghouse Motors at the Acme Mine and a General View of the Surface Equipment

Coal Production in Washington

Washington's coal production decreased from 3,979,569 tons in 1910 to 3,548,322 tons in 1911, a loss of 431,247 tons, or 10.8 per cent. The production for 1912 was 3,346,946 tons, a loss of 201,376 tons or 5.6 per cent. and a combined loss of 632,623 tons for the biennial period. This decrease is not encouraging to the coal-mining industry of the state and can be assigned to no other cause than the substitution of oil as a fuel on a percentage of the steamers running out of Puget Sound ports.

Railroads and power plants are also using a large amount of fuel oil. Just how long oil can be sold in this state, at a price that makes it more economical for steaming purposes than coal, no one seems prepared to state, but it is to be hoped for the sake of the coal-mining industry that the time is not far distant when the price of oil will advance. The value of coal per ton at the mine was $2.43 for the year 1912.

The coke production for 1910 was 57,715 tons; 1911, 40,301 tons, and 1912, 48,889 tons. The value of coke per ton at the mine, increased from $5.50 in 1910 to $5.80 in 1911, but decreased again to $5.54 in 1912.

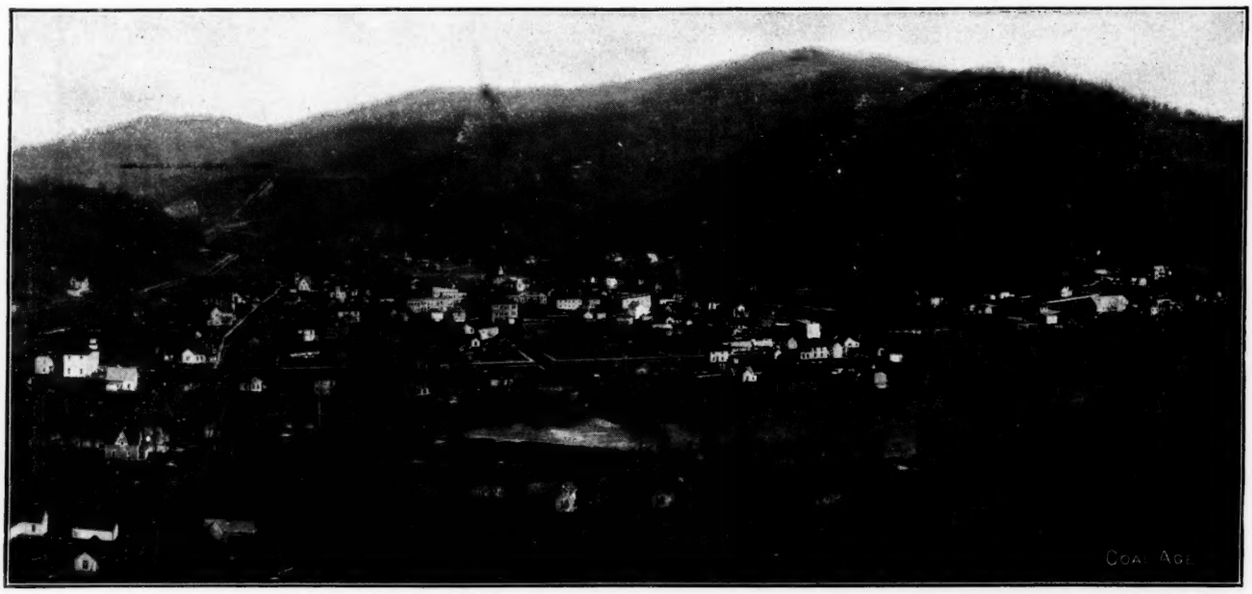
It is gratifying to report that the number of fatal accidents reduced from 43 in 1910 to 27 in 1911, and to 14 only in 1912. But the number of nonfatal accidents increased from 108 in 1910 to 115 in 1911, and in 1912 reached the high-water mark, numbering 455. This large increase of nonfatal accidents reported for the year may be ascribed to the compensation, paid through the State Industrial Insurance Commission to employees who lost time on account of injuries received while discharging their duties. The duty of this commission is to enforce the provisions of the Workmen's Compensation Act passed by the legislature of 1911. Previous to the passage of this act and following the rule of other states, only serious accidents were reported to this department; and many of these were not reported.

The Harlan Coal Field in Kentucky

By W. R. Peck and R. J. Sampson*

SYNOPSIS—A description of one of the subdivisions of the Cumberland Gap coal field. The coal lies level generally and is a high-volatile fuel possessing excellent coking properties. This district is one of the more recent ones to be opened up.

Harlan County lies in the southeastern part of Kentucky on the state line between Virginia and Kentucky, at the head waters of the Cumberland River. It is entirely cut off from Virginia and her railroads by the Cumberland Mountains and the Little and Big Black Mountains, along the crests of which runs the state line. On the western side of the county, the Pine Mountain also cuts off the main part of the county from the waters of the Kentucky River and the railroad that follows that stream. Therefore, all freight to and from the county must follow the waters of the Cumberland River.



General View of Harlan (Formerly Mt. Pleasant), the County Seat of Harlan County

Topography and General Geology

The county is very mountainous, the valleys narrow and there is only a small area of tillable land along the streams. The mountains vary in height from the innumerable low spurs to the main ridges, which in many instances rise more than 2000 ft. above the valleys. On the accompanying map are shown several elevations which give the general height of the ridges.

This district is a part of the Cumberland Gap coal field. The geological structure is that of a flat-bottomed syncline with its axis almost parallel to the Cumberland River. From this axis the rocks rise with slow dips until they are sharply upturned in the Pine Mountain on the northwest by the Pine Mountain Fault and in the Cumberland Mountain on the southeast, by the Powell's Valley Anticline. Between these two boundaries lie the Black Mountains and Martin's Fork Ridge.

*Fox, Peck & Sampson, engineers, Harlan, Ky.

The outcropping rocks in the last named mountains are sandstones, shales and coal beds. No continuous limestone beds have been found, although a bed of fossil limestone about 12 in. thick has been reported high up in the Big Black Mountain. The shales and sandstones are about equally developed, the sandstone probably predominating. The lower part is principally sandstone and contains some fairly coarse conglomerate.

The Lee conglomerate, called here the Lee sandstone, is the lowest division of the coal measures. It does not outcrop in the Harlan field, but is seen on the north flank of the Pine Mountain, where it is brought up by the Pine Mountain Fault. Above the Lee there is about 2300 ft. of sandstone and shale in nearly equal proportions.

In the Big and Little Black Mountains and Martins Fork Ridge and their spurs, occur the workable coals. The coal in the Pine and Cumberland Mountains is so badly split up and on such a heavy pitch that it is practically worthless at the present time.

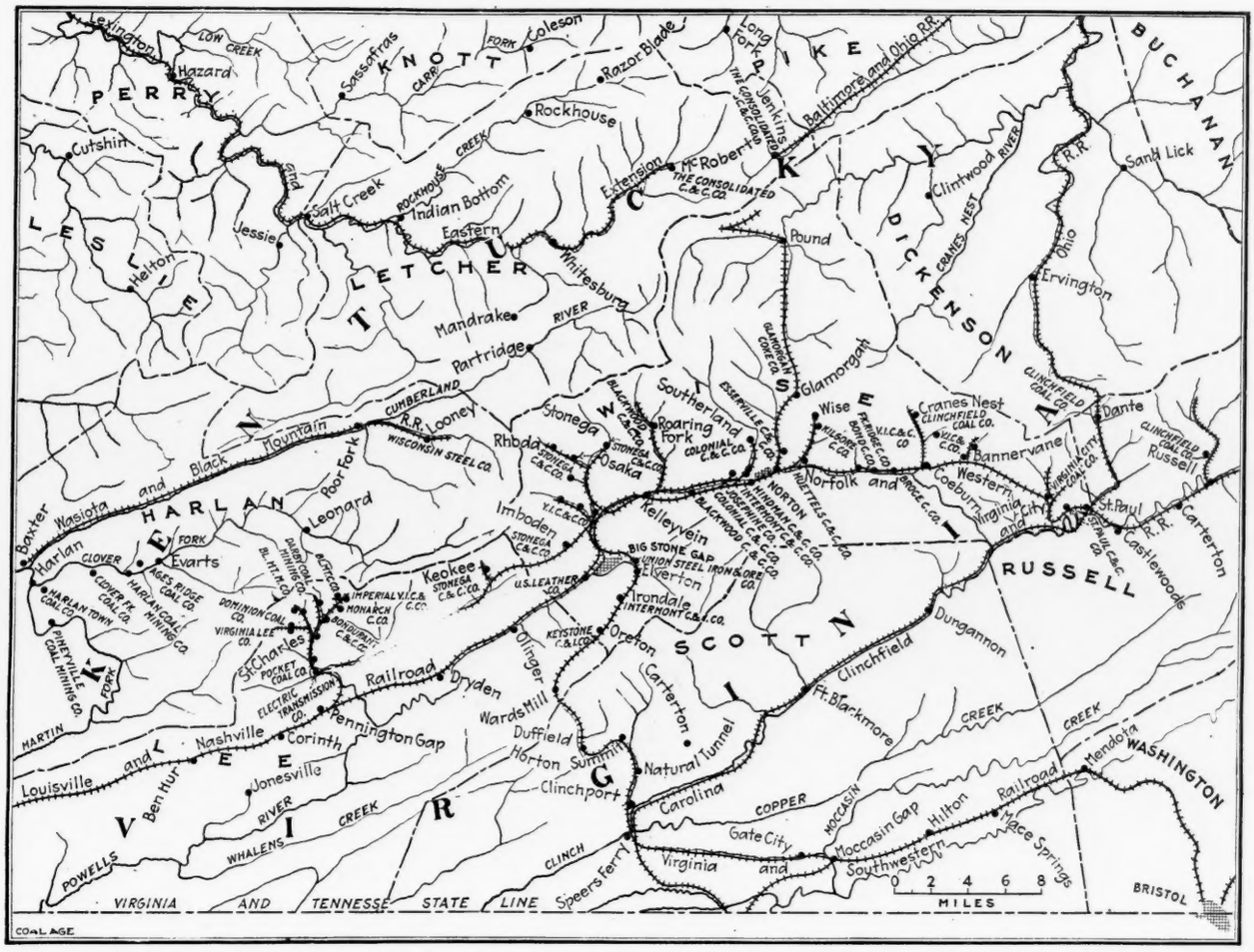
The Coals

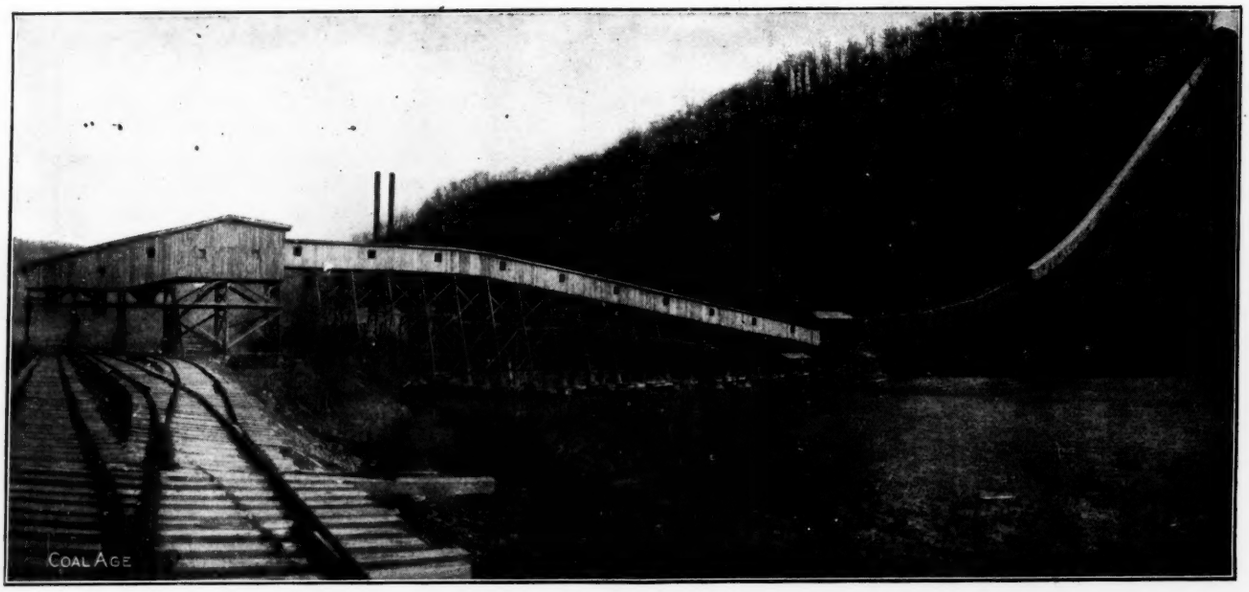
At the foot of the crest of the Black Mountains there are a great number of coal beds outcropping, but we will only attempt to describe those, which in some part of the district are of economic value, taking them in order and beginning at the bottom.

Harlan Seam—This seam, which is the lowest that is commercially workable, is the most regular and the most valuable. It lies between massive sandstone beds, the top one of which is usually less than three feet above the coal and in many instances, rests directly on it; there is probably an average of nine inches of shale between. Underneath the coal there is usually a shale bed of varying thickness, which is too hard to be cut by chain machines.

This coal is readily located by the fact that it lies 250 ft. above the Cawood sandstone, which outcrops all along the river bed, often forming prominent cliffs. It is generally known as a 4-ft. seam and has been opened in numerous places in the central, southern and western portions of the county. Eastwardly just above the mouth of Seagraves, a distance of about fourteen miles above the town of Harlan, the coal goes under the river; at this point there is 3 ft. 6 in. clean coal.

On Clover Fork, one mile above the town of Harlan, the Harlan Town Coal Co. has opened this seam. They have 50 to 56 in. of clean coal underlaid by a shale parting from 3 to 6 in. beneath which there is another


PERRY
KNOTT
LESLIE
LETCHER
HARLAN
BELL
KNOX
CLAY
LEE
WISE
DICKENSON
BUCHANAN
RUSSELL
SCOTT
WASHINGTON
VIRGINIA AND TENNESSEE STATE LINE
MILES
0 2 4 6 8
BRISTOL
Hazard
Cutshin
Jessie
Whitesburg
Mandrake
Partridge
Looney
Harlan
Evarts
Pineville
Barbourville
Corbin
Middlesboro
Jonesville
Pennington Gap
Nashville
Corinth
Dryden
Ben Hur
Louisville
Clinchport
Speers Ferry
Natural Tunnel
Carterton
Clinchfield
Dungannon
Ft. Blackmore
Castlewood
St. Paul
Russell
Dante
Cranes Nest
Wise
Glamorgan
Pound
Ervington
Clintwood
Sand Lick
Jenkins
McRoberts
Elkhorn City
Grundy
Vansant
Richlands
Tazewell
Cedar Bluff
Hansonville
Gate City
Virginia
Moccasin Gap
Hilton
Mace Springs
Hendota
Norton
Coeburn
Wilsondale
Kelleyvein
Big Stone Gap
Imboden
Roaring Fork
Southerland
Osaka
Rhodd
Stonega
Looney Creek
Leonard Fork
Clover Fork
Harlan Town
Ages Ridge
Keokee
Irondale
Oreton
Olinger
Wards Mill
Duffield
Horton Summit
Carolina
Copper Creek
Whalens Creek
Martin Fork
Powells River
Clinch River
Cumberland Mountain
Black Mountain
Wasiota
Baxter
Salt Creek
Indian Bottom
Eastern
Extension
Rockhouse Creek
Razor Blade
Coleson Fork
Carr Fork
Sassafras
Low Creek
Big Creek
Baltimore and Ohio R.R.
Norfolk and Western Ry.
Virginia and Carolina Southwestern R.R.
Clinchfield R.R.
Ohio River
Cranes Nest River
Clintwood River
Russell Fork
Big Creek
Elkhorn Creek
Levisa Fork
Big Sandy River
Kentucky River
Red Bird River
Poor Fork
Wisconsin Steel Co.
Stonega C. & C. Co.
Virginia Iron, Coal & Coke Co.
Clinchfield Coal Co.
Consolidated Coal Co.
Blackwood C. & C. Co.
Colonial C. & C. Co.
Norton Coal Co.
Kentucky Coal & Coke Co.
Virginia Coal & Iron Co.
Big Stone Gap Iron & Ore Co.
Union Steel Co.
Imperial Y. C. & C. Co.
Monarch C. & C. Co.
Bonanza C. & C. Co.
Dominion Coal Co.
Virginia Lee Co.
Pocket Coal Co.
Electric Transmission Co.
Harlan Coal Mining Co.
Clover Fork Coal Co.
Ages Ridge Coal Co.
Harlan Town Coal Co.
Pineville Coal Mining Co.
Keystone C. & C. Co.
U. S. Leather Co.
Virginia Iron, Coal & Coke Co.
Kelleyvein Coal Co.
Norton Coal Co.
Kentucky Coal & Coke Co.
Blackwood C. & C. Co.
Colonial C. & C. Co.
Consolidated Coal Co.
Clinchfield Coal



RETARDING CONVEYOR OF THE HARLAN COAL MINING CO. TAKEN BEFORE COMPLETED

eastern end of the county this seam attains a thickness of 3 ft. 6 in. of clean coal.

Kellioka Seam—This seam, which occurs about 200 to 250 ft. above the Harlan coal, has not been thoroughly prospected for in the lower or western part of the county; however, where opened it shows a section of 3 ft. 6 in. to 4 ft. It is mined at Keokee, Va., as the McConnell seam and is probably the Darby or No. 5 seam mined in the Pocket district of Virginia, as well as the Taggart seam mined at Rhoda, Va.

COMPARATIVE VALUES OF VARIOUS COALS

Note:—Due recognition must be given to the fact that all Harlan samples are taken from outcrop (weathered coal)—while others are taken from active mines, far from surface.

Seam*	Coals†	Rank	Moisture Plus	Moisture Minus	Volatile Plus	Volatile Minus	Ash Plus	Ash Minus	Value
"Standard"	"Standard"								100
	Fire Creek, New River, W. Va.	1	2.75				9.06		111.84
	Longdale Sewell, New R. W. Va.	2	1.94				1.46		103.40
	Pocahontas, W. Va.	3	2.54		1.90			1.30	103.14
	Georges Creek.	4	2.10		0.75			0.90	101.95
	Broad Top.	5	2.80		3.25			4.30	101.75
	Clearfield.	6	2.00					1.00	101.00
	Latrobe.	7	1.80			3.25		3.50	95.05
	Connellsville.	8	1.50			5.25		2.50	93.75
Harlan		9	0.49			13.27	5.02		92.24
		10	1.16			12.12	3.10		92.14
	Elkhorn, Ky.	11	0.60			12.65	3.50		91.45
		12	0.59			11.26	1.94		91.27
Kellioka		13	0.44			13.51	4.31		91.24
Creech		14		1.57		12.34	3.86		89.97
	Fairmont	15	1.40			11.50		0.50	89.40
	Thacker, W. Va.	16	1.24			10.54		1.68	89.02
		17		1.17		11.28	0.68		88.23
	Eastern Kentucky	18		1.00		10.85	0.06		88.21
	Middle Kittanning, Pa.	19	0.38			11.32		2.36	86.70
	Pittsburgh	20	1.26			11.80		4.04	85.42
Wallin		21		0.11		12.35		3.19	84.35
	Boyd County, Ky.	22		2.54		8.77		5.82	82.82
	Upper Freeport, O.	23	0.14			12.35		6.20	81.59
		24	0.71			11.15		11.07	78.49
	M. Kittanning, Ohio	25		9.18		10.77		4.00	76.05

Based on Kent's suggestion (p. 51 "Steam Boiler Economy") that a standard bituminous coal be considered as containing not over 20% volatile matter, 2% moisture and 6% ash and be rated as 100. For each per cent. of volatile matter over 25%, a reduction of 1% in value is made, and for each per cent. of moisture in excess of the standard a reduction of 2% in value is made. Also a reduction of 2% in value is made for each excessive per cent. of ash. By applying this method retroctively (the range from 20% to 25% in volatile matter being considered of equal value) the results above given are obtained.

*Name adopted by the state and U. S. Geol. Surveys 1902 and 1903. †Trade or geological names of various other selected coals in Pennsylvania, Ohio, West Virginia.

The Wisconsin Steel Co. is mining in this seam at Benham, Ky., 27 miles above the town of Harlan, where it has 5 ft. 6 in. of coal practically without a parting. There is also a seam in the eastern end of the county about 60 ft. above the Kellioka, which averages 3 ft. 6 in. of clean coal. The folowing is a typical analysis of the Kellioka coal: Volatile matter, 38.5; fixed carbon, 54.9; moisture, 1.8; ash, 3.8; sulphur, 0.96.

Wallins Creek Coal—This coal, named for Wallins Creek of Cumberland River, has a thickness of 9 ft. with a 6-in. parting, 18 in. from the bottom, leaving a top bench of 7 ft. of clean coal. It occurs approximately 600 ft. above the Kellioka. The Terry's Fork Coal Co., operating in this seam, on Terry's Fork of Wallins Creek, find a mining section of 7 ft. of clean coal. The following is an analysis of the Wallin coal: Volatile matter, 37.4; fixed carbon, 52.1; moisture, 2.3; ash, 7.6; sulphur, 0.88.

The Looney Seam, opened in several places in the high knobs of the Little Black Mountain, shows from 4 ft. 5 in. to 5 ft. of coal and usually has a small shale parting. The Lower High Splint coal lying from 300 to 350 ft. above the Looney seam in the Big Black Mountain, shows more than 3 ft. of minable coal. The Middle Splint averages about 3 ft. in the Big Black Mountain. The Upper High Splint occurs 400 ft. above the Looney and is the most valuable of the high seams in the Big Black Mountain; it varies from 4 to 6 ft. with practically no parting. In one place it shows 9 ft. 5 in. of coal with a 6-in. shale parting one foot from the floor.

HISTORY OF DEVELOPMENT

For several years past companies and individuals have been acquiring coal lands in this county. However, no move was made toward building a railroad until the early spring of 1907 when Mr. T. J. Asher began the construction of some thirteen miles up the Cumberland River, in Bell County, to reach the operations on his own property. This was known as the Wasioto & Black Mountain R.R. The Louisville & Nashville R.R. then acquired it and completed it to Benham some twenty-seven miles

THE CLOVER FORK COAL CO.'S MINING TOWN AND PRINCIPAL OPERATION

above the town of Harlan. When this line was completed, work began on a branch up Clover Fork to Ages Creek, a distance of five miles.

This branch was put into operation on the third of August. While the road was under construction leases were taken by mining companies and the installation of plants begun. At the present time there are six companies in the county shipping coal. These are the Terry's Fork Coal Co., operating in the Wallins coal on Terry's Fork of Wallins Creek, the Harlan Town Coal Co., operating on Clover Fork in the Harlan seam, the Clover Fork Coal Co., operating in the Harlan seam on Clover Fork, The Wisconsin Steel Co., operating in the Kellioka seam on Poor Fork at Benham, Ky., and the Stonega Coal & Coke Co., operating from the Virginia side in the Kellioka seam in the Big Black Mountain.

The Terry's Fork operation shipped their first car in the summer of 1911 and was the first to ship coal out of this district. They have recently installed an electric plant and their present output is from 600 to 700 tons per day. The total distance on the mountain side, through which they have to lower their coal, is about 6000 ft. This is divided into two parts, the lower end being an engine plane, the upper a gravity incline.

The Wilhoit Coal Co. began shipment in the early winter of 1911; their output is from 300 to 400 tons per day at the present time and is increasing. It is also very likely that they will install another plant on the opposite side of Ewings Creek from the present one. They have recently installed a Morgan-Gardner 150-kw. generator, belt-driven, and two Sullivan and one Morgan-Gardner short-wall chain coal cutters. Mules are still used for haulage but will eventually be replaced by electric locomotives.

The Harlan Town Coal Co. began shipment June 7, 1912. Their present output is from 500 to 600 tons per day, and is expected to reach 1000 tons in a few months. Their equipment consists of one Morgan-Gardner 250-kw. generator, belt driven, two 8-ton Morgan-Gardner, combination gathering and haulage motors and one Morgan-Gardner short-wall chain cutter.

The Clover Fork Coal Co. began shipment at practically the same time as the Harlan Town Co. Their machinery equipment consists of only a single engine to operate shaking screens. Their present output is about 600 tons per day.

The Wisconsin Steel Co.'s operation at Benham is at present by far the most important in the county. At present all of their coal is converted into coke for which purpose they have built 300 ovens of the beehive type, a breaker equipped with two crushers and flight conveyors driven by motors. The slack is conveyed to the ovens by electrically-driven larries. Their output is 20 cars of coke per day. A brick power house in which they have installed two 338-kw. and one 150-kw. generators, direct connected. There are two hundred modern mine houses of various designs and painted in different colors, a club house and handsome residence for the superintendent. A $20,000 Y. M. C. A. building has recently been opened and there is now under construction a large hotel.

The Stonega Coal & Coke Co.'s operation at Keokee, being really a Virginia mine, we will not attempt to describe it here.

The Lynn Hollow Coal Co. is installing a plant on Clover Fork. They will have no mechanical equipment but are developing for an output of 400 to 500 tons per day.

The Harlan Coal Mining Co. is working now on an installation on Clover Fork three and one-half miles above the town of Harlan. The equipment of this plant will be of peculiar interest in that they have departed from the customary gravity incline and will use a retarding conveyor of the rope-disk type. From center to center the length is 825 ft., the last 300 ft. across the river bending

on a curve of 600 ft. radius, 180 ft. of which is on a suspension bridge. At the foot the retarder discharges onto a belt conveyor 285 ft. long which carries the coal to the screens. The lump from these screens will be loaded by a boom loader. They have one Morgan-Gardner 250-kw. generator, directly connected to a Skinner engine, two Morgan-Gardner short-wall chain cutters, one 8-ton Jeffrey electric locomotive and motors for driving their conveyors and screens.

The Ages Ridge Coal Co. is now installing a plant at Ages, Ky. Their tipple will have shaking screens and eventually the mine will be equipped with gasoline locomotives.

It is reported that at least one operation will be started on Martins Fork in the immediate future. Whether this is true or not, it is only a matter of time until a railroad will be built up Martins Fork, which would tap what is really the best of the Harlan coal field. Also the road already started up Clover Fork will eventually be extended to a point opposite the town of Keokee, if it does not tunnel the Black Mountain and connect with the Virginia Southwestern R.R. at that point, or build into Appalachia, Va., there to connect with the Cumberland Valley division of the Louisville & Nashville R.R. itself.

Markets

All of the coke made in the county at present goes to the steel plants of the Wisconsin Steel Co., at South Chicago.

The coal from the other operations finds a ready market in the North, West and South, which it can reach over the Louisville & Nashville R.R. and its connections. The coal and coke from Keokee goes East and South over the Southern Railway. In general the fuels have an excellent reputation.

❖ ❖

Conservation and Commercial Advantage

By Francis S. Peabody*

SYNOPSIS—The pursuit of commercial advantage is opposed to conservation, and no one realizes this more than the miner who risks his life and reduces the coal bed to slack to increase his earnings and minimize his labor. On this subject legislation is silent. The waste of coal does not end in the mines. The railroads and the public generally are more wasteful than the coal operator.

❖

Conservation and commercialism are both concerned in the saving of our national resources. Where conservation would save human life, and maintain the worker in vigorous health, commercialism would save the energy of his labor by increasing its productivity. Where one would save natural resources, the other would reduce the waste of capital. It is strange that, while both seek the same end, which is the more perfect use of the endowments of nature, their work is, nevertheless, largely antagonistic.

Mine Safety

The State Legislature, in the interests of conservation, at its most recent session passed laws to promote the safety of life. No operator can deny that, on the whole, these laws are right. Criticisms may be directed at the mode of application provided for their enforcement, but not at the improvements demanded.

However, the natural attitude of the operator is to evade their operation, because they encumber him with a burden which is not imposed in other and rival coal-producing States. The new laws which were passed by the last legislature, especially those relating to the construction of shafts, tipples, surface buildings and fire appliances, have added at least 40 per cent. to the cost of developing a new mine, and these same enactments have increased by 10 per cent. the operating costs of old and new mines alike.

The operator is producing his coal as cheaply as he can. To do this he is taking the coal nearest to the shaft, that part which is most quickly reached and extracted, and which involves the least outlay of capital.

Under this method he is extracting less than 60 per cent. of the coal in the bed, leaving over 40 per cent. in the ground for the support of his roof, mine tipples, air courses, etc. He could mine the most remote coal first, but it would be years before he would receive a return from his capital. The profit of coal mining is, by my computation, less than 2c. per ton, and the operator does not feel justified in conserving the coal in the ground because such conservation would change this small gain into an absolute loss. Yet, by our mining methods, we are wasting money and making mining much more hazardous.

Although coal in place has doubled and even quadrupled in value in the last ten years, yet many of the largest operators in the State have become bankrupt. It is easy to obtain millions of dollars for the purchase of virgin coal land, but it is practically impossible to induce capital to invest in the coal-mining industry.

The Commercialism of the Workingman

Commercialism is frequently regarded as an attribute of large capitalists. But the miner has the quality as well as the operator. He tries to produce as large a number of tons of coal as possible with the least expenditure of labor. He rarely cares how much the coal is deteriorated in value by his careless methods of mining, how much he endangers his own life or that of others, and he is often regardless of the destruction of property.

The miner today, instead of mining by undercutting, shoots off the solid and shatters the coal, so that the fuel produced is almost unmerchantable. The percentage of screenings has increased from 20 to over 40 per cent. Not only does the miner thus destroy the coal, but he breaks the roof, knocks down timbers, makes windy shots probable, and thus endangers his own life and those of others, as well as destroys the mine in which he works.

The introduction of powder into coal mines has increased the dangers of mining. Despite the precautions

*President Peabody Coal Co., Chicago, Ill.
Note—Abstract of paper read May 9, 1913, at the dedication of the Transportation Building and the Locomotive and Mining Laboratories, University of Illinois, Urbana, Ill.

taken, 17 men lost their lives by its use last year, and 28 were injured. The law should require undercutting, and thus reduce the danger of coal-dust explosions.

The Miner Shoots for Maximum Product

The depth of drillholes used to depend on the depth of the undercutting, but a 5- or a 6- ft. hole would require from 20 to 24 in. of powder. A cartridge of 2-in. diameter, such as is generally used, contains a little over one pound of powder to the foot, so that miners should use at most only 2 lb. of powder to the shot. Such a conservative use of explosive would make shot firers unnecessary. But the coal is now largely neither undercut nor sheared. The miner drills what he terms a "buster" in the center of the coal face. Then he follows this with two rib shots. The holes are drilled from 5½ to 6 ft. long, and are angled so as to give the shots a chance to fire the coal out from the face. The cartridge is from 40 in. to 48 in. long, and contains 3½ to 4 lb. of powder to the shot. The result of such methods has been already described.

The law requiring payment for all the coal mined, whether pulverized to slack, or in lumps, was one of the most lamentable pieces of legislation imposed on the coal operators in the state of Illinois.

The people of this state are as much to blame as the operator or the coal miner. By permitting this shooting from the solid they have made mining dangerous and wasteful. And there has been a disposition to overlook the protection of property for political reasons. The legislature has restricted the introduction of labor from neighboring states, and when trouble has arisen between operators and miners it has been loathe to interfere and prevent the destruction of property. Nor have laws been passed requiring a proper recovery of the natural resources.

How Coal When Mined Is Wasted

But not only the mine owner and his employee are censurable for waste. It has been estimated that the railroads, the largest consumers of coal, utilize less than 50 per cent. of the heat in the coal which they burn under their locomotives. If 60 per cent. is wasted by the operator, and 50 per cent. of that is lost by the railroads, only 30 per cent. is actually utilized and 70 per cent. is wasted, and not the railroads only, but all consumers are equally wasteful.

Our state is one of the most advanced in protecting human life, but as these laws cripple the industry we should endeavor to assemble an interstate commission of operators and miners from the states of Illinois, Indiana, Ohio and Pennsylvania, appointed by the several governors of the various commonwealths. It should be the object of this body to recommend uniform laws to be enacted in the various states. Such laws would reconcile conservation and commercialism.

❖ ❖

Alternating-Current Fan Motors

By F. B. Crosby*

SYNOPSIS—The amount of air required to properly ventilate a mine constantly increases due to the extension of the workings. To meet this condition it has been customary to install direct-current motors driving the fans. This paper describes in more or less detail the various methods that may be employed to obtain variable speed from alternating current.

❖

It is no longer necessary for the advocate of electric drive to dwell at length upon its many advantages. The superior qualities of the electric motor are thoroughly attested by its all but universal adoption. The question which confronts the engineer today is not that of relative merits of the several possible methods of transmitting energy to the point of application, but rather the intelligent selection of the most suitable electrical equipment with due consideration of all factors bearing upon the particular case in hand.

Recognizing the limitation of design and the physical impossibility of producing a universal motor, electrical manufacturers are giving more and more attention to the specific requirements of certain clearly defined classes of service. As a result of this specialization and the steadily increasing variety of forms manufactured, it is obviously of great importance that for any given duty the proper motor be selected, otherwise a motor which under conditions for which it is designed, would give entire satisfaction, may under different conditions prove an utter failure or at best needlessly expensive.

Induction motors can be readily designed to develop at reduced speeds:

a. Constant horsepower—increasing torque.

b. Constant torque—horsepower proportional to speed.

c. Torque decreasing with speed.

Moreover these motors can be given either a maximum or overload rating. The power required to drive a centrifugal mine fan varies approximately as the cube of the speed. Obviously to install for fan service a motor capable of developing constant horsepower at reduced speeds or with any considerable overload capacity, does not represent sound engineering, either from the standpoint of first cost or operating characteristics.

It is the purpose of this paper to indicate certain considerations which should govern the selection of the mine fan motor and describe briefly those types which have been adapted to this service. No attempt is made to discuss the relative merits of the several types of fan on the market or forced draft as compared with the suction draft fan. It is assumed that the type of fan and horsepower required to operate it have been determined for any given application.

Two general conditions arise requiring (1) constant speed drive, and (2) adjustable speed drive. Until recently, for adjustable speed drives, it was practically necessary to install direct-current motors. This necessity no longer exists. In laying out new installations

*A paper presented at the Pittsburgh meeting of the American Institute of Electrical Engineers, Pittsburgh, Penn., Apr. 18, 1913.

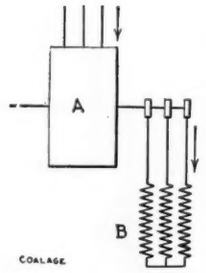


FIG. 1. INDUCTION MOTOR AND RHEOSTATIC CONTROL

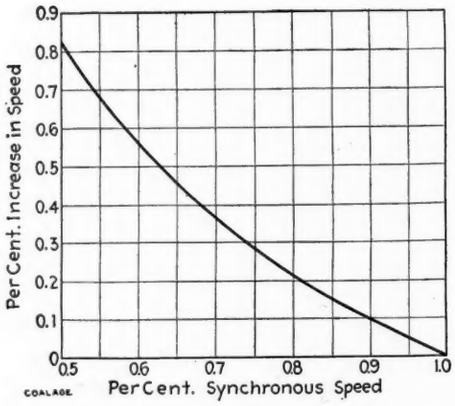


FIG. 2. INCREASED SPEED CORRESPONDING TO DECREASED TORQUE

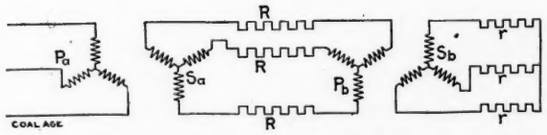


FIG. 5. CONCATENATED WINDING

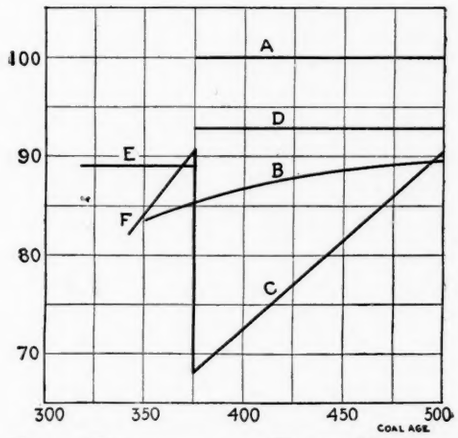


FIG. 4. EFFICIENCY AND POWER FACTOR, TWO-SPEED MOTOR

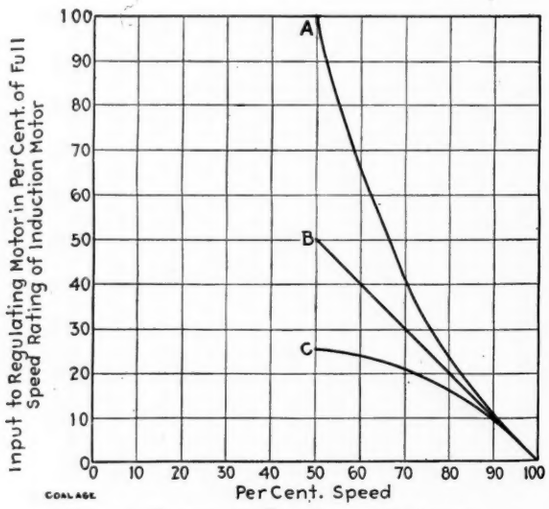


FIG. 8. INPUT TO REGULATING MOTOR

A. Constant horsepower.
B. Constant torque.
C. Horsepower proportional to speed squared.

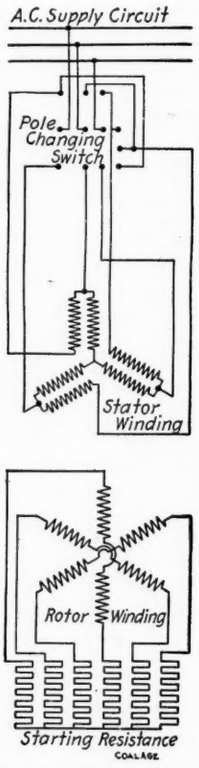


FIG. 3. MULTI-SPEED MOTOR WINDINGS

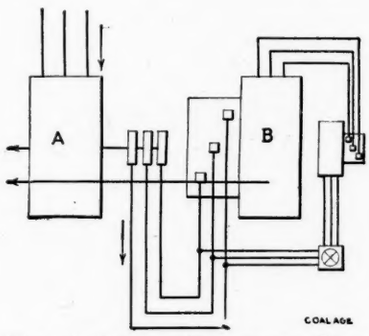


FIG. 10. DIRECT-CONNECTED COMMUTATOR MOTOR

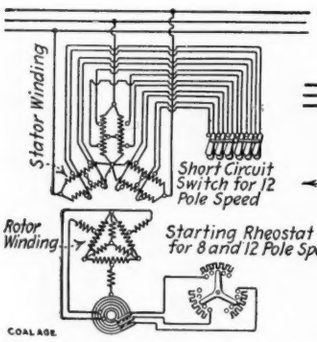


FIG. 6. SINGLE CASCADE WINDING

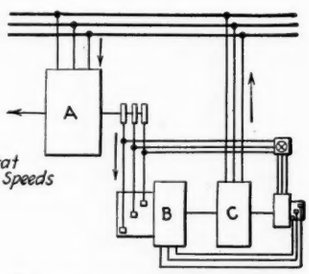


FIG. 7. INDUCTION MOTOR WITH REGULATING SET

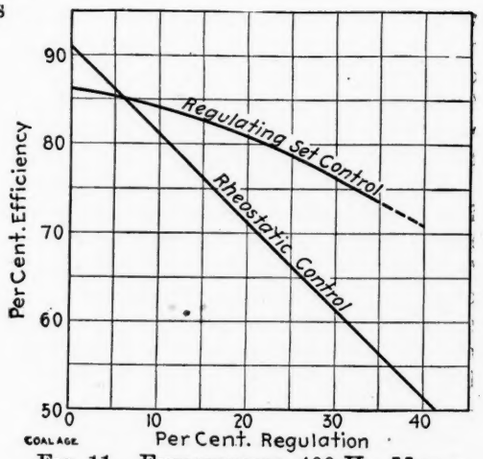


FIG. 11. EFFICIENCIES, 400-HP. MOTOR

not handicapped by an existing direct-current system, alternating-current motors only need be considered.

In the following discussion the term "constant speed" implies no appreciable change of speed from no-load to full load; "variable speed" implies speeds varying with the load, but constant at constant load; "adjustable speed" implies several independent speeds, each constant under varying load. In either case the polyphase alternating current motor in some one of its several forms meets all requirements.

I. Constant-Speed Drive

This is obviously the simplest condition met with and is found chiefly in connection with long railway tunnels, subways, and old mine workings in which the volume and pressure of air handled is practically constant twenty-four hours a day and every day in the year. For such service the standard polyphase induction motor is without a competitor. Properly installed, such a motor can be stopped or started automatically in emergency by remote control and will run constantly without attention other than occasional inspection of the oiling system.

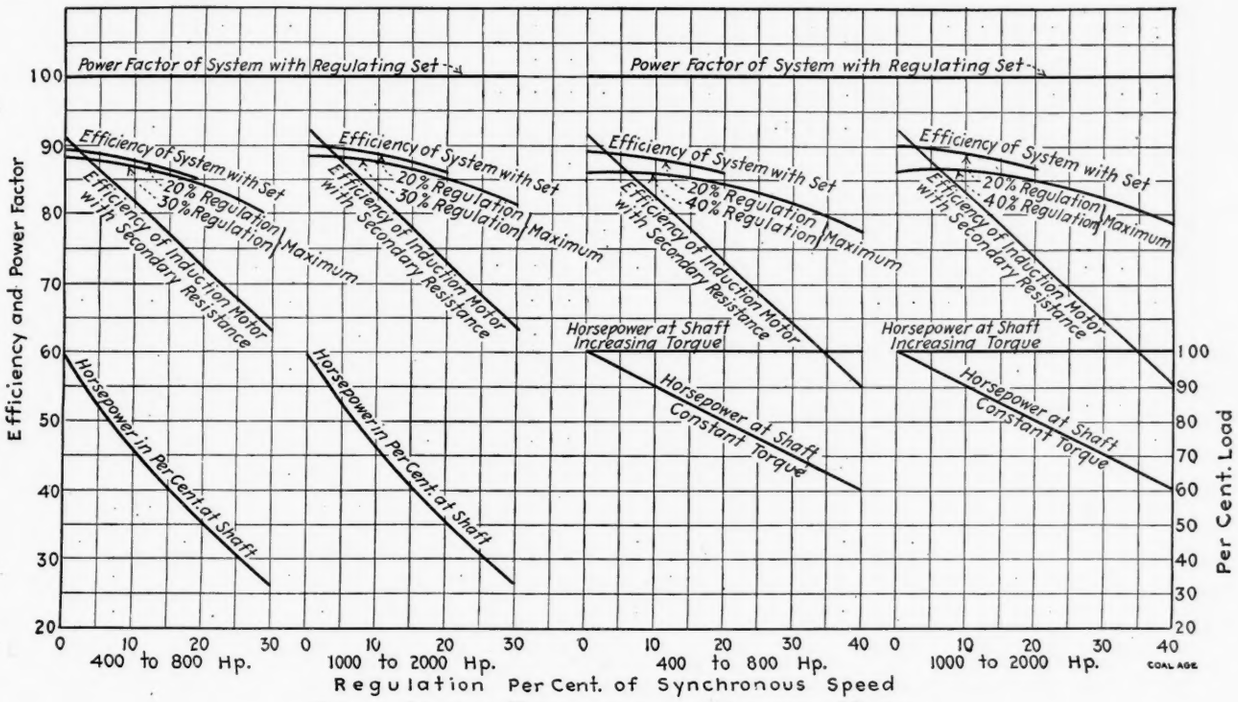

Power Factor of System with Regulating Set
Efficiency of System with Set
20% Regulation
30% Regulation
Maximum
Efficiency of Induction Motor with Secondary Resistance
Horsepower in Per Cent at Shaft
Horsepower at Shaft Increasing Torque
Horsepower at Shaft Constant Torque
40% Regulation
Efficiency and Power Factor
Per Cent. Load
400 to 800 Hp.
1000 to 2000 Hp.
Regulation Per Cent. of Synchronous Speed
COAL AGE

Fig. 9. Overall Efficiencies of Induction Motors

II. Adjustable Speed Drives

The great majority of mine fan installations require an adjustable speed drive and for this reason, as stated above, until comparatively recently it has been practically necessary to install direct-current motors with shunt speed characteristics.

The average fan motor operates under practically constant load throughout long periods, consequently maximum efficiency is a consideration secondary only to the reliability of operation. The direct-current shunt motor shows a fairly high efficiency throughout its range of operating speeds but its installation is subject to the inherent disadvantages of the first cost, maintenance, and attendance of a direct-current generating and distributing system. As compared with these disadvantages the many desirable characteristics of the induction motor have frequently led to its installation even at the cost of a compromise between efficiency and desirable operating speeds. Numerous schemes for obtaining speed control for polyphase induction motors have been developed. Among those of chief importance are the following:

1. Constant speed motors with changeable pulleys.
2. Variable speed motors with rheostatic control.
3. Multi-speed windings.
4. Concatenation.
5. Single cascade motors.
6. Dynamic regulation.
7. Brush shifting motors.

1. *Changing pulleys* is obviously a make-shift method subject to annoying delays and limitations such as practical ratio of pulley diameters, and distance between center lines of shafts, etc.

2. *Rheostatic Control.* When operating with negligible secondary resistance the polyphase induction motor is inherently a constant speed machine. Continuous speed control can be had by means of an adjustable resistance in the secondary circuit but the efficiency falls rapidly as the range of operating speeds is increased. (Fig. 4). In Fig. 1, A is the main motor and B is the external secondary resistance. Assuming that 50 per cent speed reduction by rheotatic control is required, it follows that the shaft output, with fan load must be approximately $(\frac{1}{2})^3 = 12.5$ per cent, and an equal amount of energy must be dissipated in the rheostat in addition to the losses in the motor itself. The effect on overall efficiency is obvious.

Another vital objection to rheostatic control lies in the fact that with external resistance in the secondary circuit, the speed varies with the load, accelerating under light loads and dropping again, to a value determined by the secondary resistance when the load comes on. Since at

no-load the secondary current is negligible, no amount of resistance within reasonable limits will hold down the speed of the motor.

Fig. 2 shows increase in speed of motor corresponding to several initial speeds when the load is changed from 1¼ to ¼ times full load torque.

3. *Multi-Speed Windings.* Where two definite constant speeds are sufficient the induction motor can often be supplied with external connections by means of which the polar grouping can readily be changed to give the desired synchronous speeds.. The cost of such a motor is but slightly more than that of a single-speed motor provided a 2:1 ratio is employed for the high and low speeds. Where a ratio other than 2:1, or where three or four constant speeds are required, the condition can sometimes be effectively met by two separate windings in the same slots, one or both of these windings being arranged for external multi-polar grouping. Three separate windings are not permissible in practical design. Such motors are sometimes used with or without changeable pulleys and rheostatic control for intermediate speeds but at best are a compromise, since the number of constant speed steps is limited by characteristics of design and by prohibitive costs. Rheostatic control is always objectionable for reasons noted above.

Fig. 3 shows diagrammatically the arrangement of stator and rotor windings for a two-speed changeable pole motor.

Fig. 4 shows typical efficiency and power factor curves for a two-speed motor with rhoestatic control.

4. *Concatention.* Another method of obtaining three or more constant speeds, particularly where low speeds are required, has been employed abroad for mine fan service. This scheme employs segregated electrical and magnetic circuits and is known as operating in "cascade" or "concatenation."

In general two single-speed motors, one of which at least has a polar wound rotor, are mounted on the same shaft. The primary of motor *A* is connected to the secondary of motor *B*. Each of these motors may have either single or multi-speed windings and may be operated independently of the other as well as in concatenation. The second motor may have either a phase-wound or squirrelcage rotor. In case phase-wound rotors are used, speed regulations by secondary rheostatic control may be obtained in the usual manner, and with the usual objections.

Two motors are connected in direct concatenation if they show a tendency to start in the same direction and in differential concatenation if they tend to start in opposite directions. The synchronous speed of motors in concatenation may be determined as follows:

$$Speed = \frac{cycles \times 120}{P_1 \pm P_2}$$

where P_1 = number of poles of first motor and P_2 = the number of poles of the second motor, the plus sign being used for direct and the minus for differential concatenation.

With the multi-speed pole changing motors it is necessary to open the primary circuit when changing from one speed to the other, this may be avoided in concatenated sets by introducing resistance in the leads between the two motors, the resistance being cut in or out step by step when changing speeds (Fig. 5).

As noted with a polar-wound rotor, any reduction in speed by rheostatic control is accompanied by a proportionate reduction in efficiency, the power factor remaining practically constant. With concatenated motors the efficiency remains approximately constant provided there is no external resistance in the rotor circuit of the second motor, while, at the lower speed, the power factor drops, due to the fact that as compared with their normal individual ratings, the motors are underloaded when in concatenation.

5. *Single Cascade Motor.* The single cascade motor offers still another method of obtaining two or three definite fixed speeds. This motor has an internally concaternated winding. The stator windings are of the usual full- and half-speed types. The single winding of the rotor is so arranged that its magnetizing effect is the same as would be produced by two separate windings. It is, however, a decided improvement over two separate windings, since all coils which, in such cases, would neutralize each other, are omitted in the concatenated connection

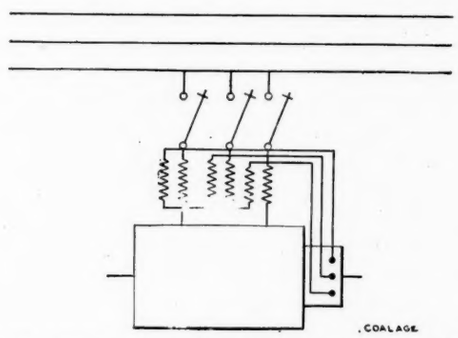


FIG. 12. CONNECTIONS FOR BRUSH-SHIFTING MOTOR

and grouped together for connection to the slip rings for use only at other speeds. When the primary of the first element is properly connected with two circuits per phase in multiple corresponding to the number of poles, these circuits are in exact opposition for the number of poles in the second element and form a perfect path for short-circuiting the secondary of the second element. The stator winding, therefore, carries two currents simultaneously (1) a current from the line at full frequency and (2) induced current at a frequency corresponding to the slip. The general arrangement of windings is shown in Fig. 6.

By inserting a variable external resistance between certain points in the stator windings and open-circuiting the collector rings, variable-speed control can be obtained for the concatenated connection. Resistance across the collector rings gives ordinary variable-speed characteristics for the other two speeds.

This type of motor is particularly adapted to the three speeds corresponding to the polar ratios 1-2 and 3, for example 4-8-12, 6-12-18, etc.

6. *Dynamic Regulation.* As stated earlier in this paper, each of the foreging schemes possesses inherent disadvantages which until recently have made it practically necessary to employ a direct-current motor with shunt characteristics whenever close regulation was required for a large number of speeds each constant under varying loads.

Recently means have been perfected whereby shunt speed characteristics can be had with the standard poly-

phase induction motor, together with high-power factor and high efficiency throughout the range of operating speeds. The method employed is susceptible of several modifications and will be referred to inclusively as dynamic regulation. With rheostatic control the secondary energy is dissipated as heat whereas with dynamic regulation the major portion of this energy is returned to the system. Referring to Fig. 7, the external resistance *B* of Fig. 1 is replaced by the compensated commutator motor *B*, which forms one element of a two unit motor-generator set, the second element of which is a standard squirrel-cage induction motor connected to the supply mains. This machine is driven slightly above synchronism by the commutator motor and operating as an induction generator returns to the system energy proportional to the slip of the main motor, less the losses in the set

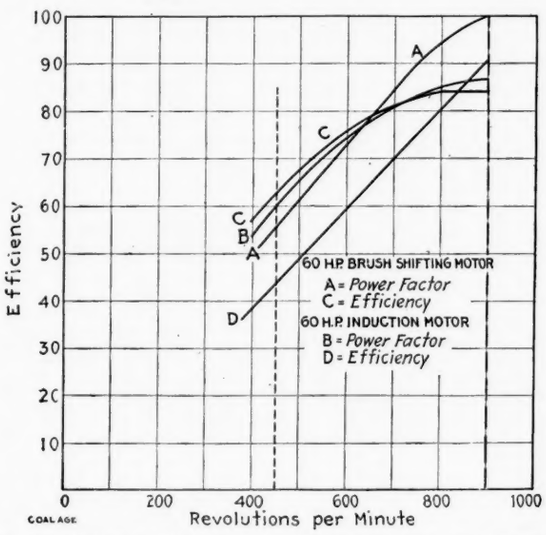


FIG. 13. POWER FACTOR AND EFFICIENCY FOR BRUSH-SHIFTING MOTOR

itself. The commutator motor receives energy from the secondary of the main motor at relatively low frequencies and in general must have a proportionately small percentage of the main motor capacity. Assuming that *A* is to drive a fan at 50 per cent. of synchronous speed the horsepower delivered to the fan will be approximately 12.5 per cent. of the rated capacity of the motor and the same amount of energy will be delivered to the regulating set.

If the connected load required constant horsepower at the motor shaft, then neglecting losses, the motor input at 50 per cent. speed would be 200 per cent., the shaft horsepower 100 per cent. and the energy returned to the system 100 per cent.

If again the connected load required constant torque at the motor shaft, then neglecting the losses the motor input would be 100 per cent., the shaft output 50 per cent., and 50 per cent. would be returned to the system. This is shown graphically in Fig. 8. If *X* per cent. regulation is required the motor generator set must have *X* per cent. of capacity of the main motor: Fig. 9 shows typical curves of efficiency and power factor for the conditions indicated above with dynamic regulation and rheostatic control. Where standard regulating sets are employed they can be of relatively high speed and inexpensive design as compared with the slow-speed main motor.

Fig. 10 shows a modification of the above scheme in which the commutator motor *B* is direct connected to the main motor shaft. In this case the slip energy of the main motor is transformed to mechanical energy and the torque of *B* added to the torque exerted by the main motor *A*. This arrangement is especially desirable where constant horsepower must be maintained at the shaft. For fan service, however, the high-speed self-contained regulating set is usually cheaper and yields equally satisfactory results. Furthermore, the possibility of applying the standard regulating set to any standard induction motor with phase-wound rotor in event of future re-arrangement of equipment, is an important advantage.

In addition to the advantages of adjustable constant speeds under varying load and high operating efficiency the possibilities of power-factor correction are often of great importance. If desired, unity power factor can be maintained on the main motor with all the usual beneficial results in improved regulation and increased energy capacity in power-station and transmission system. Unity power factor correction naturally involves a somewhat more expensive set since the magnetizing current is supplied by the commutator motor instead of from the line. The standard sets should have sufficient capacity to raise the power factor of the main motor about 10 per cent., maintaining an average power factor of 95 per cent., or, in some cases, 100 per cent. without increased cost. In special cases it is possible to supply sufficient magnetizing current from the commutator motor to give the main motor a leading power factor, thus obtaining a certain corrective effect for low power-factor conditions on the external system. The kilovolt-ampere capacity, copper losses and first cost will be increased and the overall efficiency lower in this case.

The operation of the set with magnetic control is very simple. The induction generator is thrown across the line by means of a standard compensator and brought up to speed as an ordinary squirrel-cage motor. The main motor is started by closing the primary oil switch and accelerated by automatic current limit control. The speed of the main motor adjusts itself to the tension determined by the setting of the exciter field rheostat. Any further speed adjustment is obtained by the manipulation of this exciter field rheostat.

The range of speed regulation obtained is limited by the maximum frequency impressed on the commutator motor. In general for good design this should not exceed approximately 20 cycles, which will give about 30 per cent. regulation on a 60-cycle motor. This limit varies somewhat with the size of the motor involved.

This system was developed in Europe and in the past four years about thirty equipments have been put in successful operation for mine fans and rolling mills. Three similar equipments have been sold in this country within the last six months.

Fig. 11 shows efficiency curves for two 400-hp motors driving a mine fan, with regulating set and with rheostatic control. Two of these motors were actually installed and operated continuously at 40 per cent. speed regulation by rheostatic control for nearly a year. Under these conditions the input to the fan would be 21.6 per cent., and the energy dissipated in the rheostat or delivered to the regulating set 14.4 per cent., of the full load rating of the motor.

From the curves the relative over-all efficiencies with

rheostatic and dynamic control are seen to be 51 per cent. and 70.5 per cent., respectively. The relative power consumption is therefore 169.5 hp. and 122.5 hp., or a net saving of 47.0 hp. per machine in favor of the regulating set. Assuming that power can be purchased for 1 cent per kw.-hr., the net saving due to the use of a regulating set with each fan 12 hr. per day, 300 days per year, would be $0.01 \times 47.0 \times 0.746 \times 12 \times 300 \times 2 = \$2525$, approximately. In many gaseous mines the fans must operate continuously 24 hours per day every day in the year, which would make the net savings $6160.

7. *Brush Shifting.* For fan installations requiring motors of 100 hp. or less capacity, in place of the regulating sets described above, the brush shifting polyphase motor can often be employed to advantage. Fig. 12 indicates the general arrangement of connections for this type of motor. The motor derives its name from the fact that it is started, stopped, reversed and controlled by merely shifting the brushes.

With a certain brush setting no torque is developed, consequently the motor will not start when the line switch is closed until the brushes are moved from this position. The speed of the motor is proportional to the brush shift. Reverse operation can be obtained by moving the brushes in the opposite direction from the zero position, but for best commutation two phases should then be reversed.

Brush shifting is accomplished by means of a suitable worm gear and handwheel conveniently located. Commutation is excellent throughout the entire speed range. Fig. 13 shows power-factor and efficiency curves for a 60-hp. brush-shifting motor and for an ordinary induction motor with rheostatic control designed for fan service. These curves were plotted from actual test data. The minimum permissible speed depends largely upon the torque requirements of the driven load. For fan service this type of motor will give stable operations at quite low speeds corresponding approximately to 70 per cent. slip below synchronism.

In conclusion it would appear to the writer that in the absence of an existing direct-current system, the advantages of the polyphase motor leave small ground for the application of direct-current motors for either constant or adjustable-speed fan drive.

❋

Mine Inspectors' Institute, U. S. A.

The announcement has just been received of the fifth annual meeting of the Mine Inspectors' Institute of the United States of America, to be held June 10-13, 1913, at Birmingham, Ala. This is actually the sixth annual meeting, counting the conference of mine inspectors, held at Indianapolis, Ind., June 9-12, 1908. Following this first conference, annual meetings have been held at Scranton, Penn. (1909); Chicago, Ill. (1910); Charleston, W. Va. (1911); and Columbus, Ohio (1912).

All members of the Institute and all regularly commissioned inspectors of mines, in the United States and Canada, are urgently requested to attend the meeting at Birmingham. The purpose of the meeting, as stated, is to afford an opportunity to the mine inspectors of the states and provinces of North America to exchange ideas and discuss subjects relative to greater safety in mining.

All members are requested to furnish the secretary, at the earliest possible date, the title of any paper or subject they may desire to present for discussion. The following subjects are suggested as being of sufficient importance for presentation and discussion:

1. Compensation laws as they affect the miner and operator.
2. The phenomena of retarded ventilation at firing time.
3. The use of portable electric lamps by miners at the working face.
4. Need of uniformity of danger signals in mines.
5. Precautions to be observed in restoring ventilation after a mine explosion.
6. How to secure the coöperation of the miner in the reduction of accidents.
7. The use of mixed lights in mines.
8. Election versus appointment of State Mine Inspectors.
9. Ventilation in metalliferous mines.
10. Hardships imposed upon State Inspectors.

Members are earnestly requested to prepare papers on one or more of these or other subjects and to send a copy of the same to the secretary not later than June 1.

Birmingham and vicinity offers many opportunities to see coal and ore mining, blast furnaces, coke ovens, steel mills, mine sanitation, rescue stations and first-aid organizations.

If a member or a mine inspector, you are cordially invited to attend this forthcoming meeting. The State Mine Inspectors, the state and city officials, and the Chamber of Commerce of Birmingham will lend their assistance to make the meeting a success, and those who attend will have a touch of real Southern hospitality.

JAMES W. PAUL, Secretary.

❋

A New Chapter of the Rocky Mountain Coal Mining Institute

BY F. J. MULLEN

A meeting was held at Koehler, N. M., on May 3, for the purpose of organizing a New Mexico Chapter of the Rocky Mountain Coal Mining Institute. The following members were present:

T. H. O'Brien, Allan French, Wm. McDermott, John W. Morris, Walter Kerr, J. B. Morrow, M. G. Smiglow, Frank Stafford, Frank R. Weitzel, Sebastian Frohmann, Archie French.

The following members were enrolled:

William Kilpatrick, Dawson New Mex.	H. B. Kerr, Van Houten, New Mex.
Tim Tinsley Dawson New Mex.	Alex Stewart, Van Houten, New Mex.
Wm. Hutchings Dawson New Mex.	Wm. Niel, Van Houten, New Mex.
F. J. Mullen, Dawson, New Mex.	James Stewart, Van Houten, New Mex.
Wm. Gordon, Dawson, New Mex.	T. W. Wallbank, Van Houten, New Mex
Warren Bracewell, Dawson, New Mex.	Frank A. Young, Raton, New Mex.
Moses Saul, Dawson, New Mex.	Walter Lovett, Raton, New Mex.
James Lees, Dawson, New Mex.	J. L. Caruthers, Raton, New Mex.
C. A. Mitke, Dawson, New Mex.	J. H. Willis, Gardner, New Mex.
Peter Gardner, Brilliant, New Mex.	J. Burkhalter, Gardner, New Mex.
James Bell, Brilliant, New Mex.	Adam French, Gardner, New Mex.
Joe Connor, Koehler, New Mex.	T. C. Harvey, Sugarite, New Mex.
John Evan, Koehler, New Mex.	Vincent Donati, Sugarite, New Mex.
Wm. Britton, Koehler, New Mex.	Adam Pagliai, Sugarite, New Mex.
James Wallace, Koehler, New Mex.	A. H. Beamer, Sugarite, New Mex.
Menzie Wyper, Koehler, New Mex.	Wm. Langley, Sugarite, New Mex.

The following officers were elected:

President, Walter Kerr; Secretary-Treasurer, Wm. McDermott; Members Executive Board, Allan French, T. H. O'Brien, Wm. Kilpatrick, Peter Gardner.

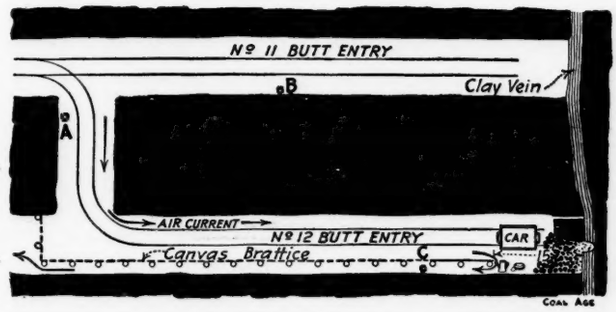
Owing to the short time at hand for the formation of the chapter, nothing else was attempted but the organization. However, at the next meeting, which will probably be held at Dawson, N. M., several excellent papers are promised for reading.

The Koehler "bunch" cannot be beaten on entertainment. A "swell" dutch lunch was provided for all those who desired to partake thereof, and added greatly to the sociability of the meeting.

The Cincinnati Mine Explosion

In addition to the meager accounts thus far obtainable in regard to the explosion that occurred in the Cincinnati mine of the Monongahela River Consolidated Coal & Coke Co., at noon, Apr. 23, 1913, in which 96 lives were lost, we have recently received a detailed sketch of the face of the heading, where the explosion is thought to have originated. This is No. 12 butt entry off No. 14 face entry.

According to the evidence given at the coroner's jury, which completed its work May 13, and whose verdict, in full, we append, the explosion was started by the ignition of a body of gas that had accumulated at the face of No. 12 butt entry. The No. 12 butt entries were being driven to open up a new portion of the mine. As shown in the sketch, one of these entries was being pushed ahead and was ventilated by a brattice, consisting of canvas nailed to a line of posts set about 2 ft. from the right-hand rib of the entry. The coal was drawn out from the face of the entry through the last cut-through, and the air current was conducted through the same cut-through to the face of that entry and returned behind the brattice.



SHOWING FACE OF NO. 12 BUTT ENTRY WHERE EXPLOSION STARTED

The entryman had fired a shot at noon and had retired to the cut-through, where he ate his lunch at the point marked *A*. The face of the entry had struck a clay vein and the shot fired had penetrated this vein, and it is supposed had opened a feeder of gas, which is very apt to occur when an opening is driven through a fault. The gas from the feeder had accumulated in considerable volume at the face of the entry while the entryman was eating his dinner.

As no gas had been discovered in this portion of the mine since Mar. 5, 1913, according to the reports of the fireboss, the entry was being driven with open lights, no safety lamps being used. As a consequence, when the miner returned to the face of the heading, after eating his lunch, he unconsciously walked into and ignited the gas that had accumulated. The burning gas evidently developed into a violent explosion a short distance from the face, as the last 10 ft. of the brattice near the head of the entry was left intact, while the remainder was entirely destroyed, as shown by the dotted line in the sketch. The bodies of the two men who were killed in these entries were found at the points marked *B* and *C*. The miner's cap and the lamp (a common miner's torch or lamp), were found at the end of the brattice, as shown in the sketch. When the miner returned from his lunch, he had brought in with him the empty car shown at the head of this entry. The explosion that developed gained force in its passage throughout the mine, and, as a result, 96 lives were ushered into eternity with but slight warning.

Inasmuch as the verdict and recommendations of the coroner's jury are somewhat out of the ordinary, we give them in full for what they are worth. They are as follows:

The Verdict

We, the jury, find that Stephen Long and the 95 others named came to their death in the Cincinnati mine of the Monongahela River Consolidated Coal and Coke company, Washington county, Penn., on April 23, 1913, from violence and asphyxiation as a result of an explosion of gas in the said Cincinnati mine at about 12:15 p.m., while the miners were at work and the mine in operation.

We further find from the evidence given by those that worked in the mine at the time of the explosion and previously, also the state mine inspectors, experts and officials and others who made an investigation and examination of the mine after the explosion, that the cause of the said explosion of gas was as follows:

(a) That it originated in No. 12 butt entry off No. 14 face entry, as a result of the entryman, who worked in said entry, firing a butt shot which struck a clay vein exposing a feeder of gas. After firing said shot, the entryman evidently went to the break to eat his dinner and on returning with an empty car he ignited the gas with his open light with which he was permitted to work; we also find that no gas has been reported in said entry since March 5, 1913, by any of the mine officials.

(b) Further, that said explosion of gas which we find originated in said No. 12 entry reinforced itself in other entries, namely: Nos. 4 and 6 entries in which gas was generated and had been reported by the mine officials at different times and which entries were being worked with safety lamps.

(c) We further find that said explosion could have been prevented had safety lamps been used in this section of the mine.

(d) While under the law the legal responsibility for any explosion such as this would rest on the mine foreman, we say frankly that a greater responsibility rests upon the lawmakers and particularly upon those responsible for its enactment, for the reason, that it places the entire responsibility for the operation of the mine on the man granted a certificate of competency by the state but employed and paid by the owner and operator of the mine; certainly an absurdity on the face of it, and one that under human events will not successfully protect life either in theory or practice. If the present system must continue, surely the legal responsibility ought to be placed upon the owner or operator equally with the mine foreman. Guided by the testimony given, opinions expressed by those in official capacity as well as those employed in and about the mine we make the following recommendations:

Recommendations

First. To the management of the Cincinnati mine: That hereafter it be operated by safety lamps as a whole, and that no machinery be used that would make possible the emission of sparks. Surely the lesson to be learned here is the folly of working a gaseous mine with part open and part safety lamps.

Second: To the legislature and senate of this state: That if it is your desire to make safe the operation of mines, that in the enactment of mining legislation you be guided more by the opinions of those intrusted with the responsibility of safe-guarding lives, namely, the state mine inspectors, the mine foreman and the miner, rather than by the opinion of the corporation, attorneys and managers of corporations, who, from a careful reading of the present law, seem to have in mind the competitive nature of business and the protection of property rather than the safe-guarding of human life.

Third: To the Department of Mines: We recommend that a more definite report be required from the firebosses and mine foremen in respect to the dangers existing in the mine, in their daily and weekly reports. For instance, if gas be discovered, that they be required to state in what part of the working place it was found, whether it be on a fall, or in a clay vein, roof, or the face of the working place and if possible in what volume.

Fourth: We call attention to this fact that while many of the mines of this district are working in whole or in part with safety lamps it is not because of any legal requirement,

but rather because of the diligence of the inspectors. Hence, until the final authority for the safe operation of the mines be vested where it should be, in the state inspectors of mines, without the right of the reverse of appeal by common pleas and supreme courts with all its delays, that the owners and operators or managers of mines cheerfully comply with the recommendations of inspectors, particularly those made for the purpose of safeguarding life and they should not be considered a business hardship.

Further, we recommend that, at any mine where gas is or has been discovered or is being generated, they be worked with safety lamps and other necessary precautions and that the use of machinery that caused emission of sparks be discontinued. We have carefully considered the evidence and law and the opinions expressed by those who testified, and feel that we have placed the responsibility for the explosion where it properly belongs, namely, on the mine foreman (legally), as we believe through an error of judgment on his part he permitted part open and part safety lamps in that part of the mine where the explosion took place; but we place a greater responsibility, morally, on those responsible for the framing and enactment of such a law.

Signed:

C. H. LANDEFELD, Foreman,
T. J. ECKBRETH,
B. S. ALLEN,
W. F. ALTEN,
J. D. HOON,
ISAAC YOHE.

Plant of the Empire Coal & Coke Co.

Our front cover this week shows the plant of the Empire Coal & Coke Co. at Landgraff, W. Va., on the main line of the Norfolk & Western R.R., about 10 miles east of Welch. This is one of the most modern and uptodate tipples in the Pocahontas field.

The proper cleaning and sizing of the coal from this mine yields an increase in the market value approximating 15 to 20c. per ton upon the entire output. As the type of coal handled is a soft and brittle grade of Pocahontas, it has to be treated with extreme care to prevent degradation in sizes.

This tipple has a capacity of 500 tons per hour, and spans four loading tracks. It is so equipped that the coal is conveyed, sized, picked, mixed in any proportion desired, and loaded without appreciable breakage.

The mine cars are dumped at a point about 70 ft. above and 175 ft. south of the inside track. The coal is discharged from the mine cars into a 10-ton steel receiving hopper, from which it is delivered by a reciprocating plate feeder to a scraping conveyor, having steel flights 12 in. wide by 5 ft. long, placed every three feet on two 18-in. pitch sprocket chains. This conveyor is 135 ft. long between centers, and delivers the coal to shaking screens, where it is graded into slack, nut, egg and lump.

The slack coal passes by gravity to a 200-ton steel bin, from which it is carried, either by a 32-in. rubber belt conveyor to cars for shipment or by a scraper conveyor to a crusher and pulverizer, where it is reduced to uniform fineness for coking, and deposited by a 90-ft. bucket elevator in a 25-ft. diameter cylindrical steel larry bin at the end of the tipple.

The nut coal passes first to a revolving screen, where it is more thoroughly cleaned, and is then delivered to the nut picking table. This discharges either into cars direct or into a mixing conveyor. The egg and lump coal pass directly from the screen to their respective picking tables. These also deliver to cars direct or into a mixing conveyor.

The refuse is removed by hand from the picking tables, and deposited in a refuse conveyor, which runs parallel to and between the picking tables, but in the opposite direction. This discharges into a steel refuse tank located over a track at the end of the tipple.

The picking tables for lump and egg coal are each 5 ft. wide and 68 ft. long between centers, and both have hinged or adjustable loading booms, which are capable of being raised or lowered so as to discharge the coal into either the mixing conveyor or the railway cars without breakage.

The mixing conveyor runs at right angles of the picking tables, receiving coal from any or all of them simultaneously, and delivering it to the cars, mixed in any proportion desired.

All shaking screens are equipped with veils which permit of variation in the size of the product or the shipment of mine-run coal. From these screens the coal passes to the picking tables, practically without drop or breakage. The entire mechanical system consists of six units, each of which is driven by an independent motor and all operations are controlled by one man from an elevated bridge in the picking house.

The operation of this plant, which was designed and built by the Jeffrey Mfg. Co., of Columbus, Ohio, has been highly satisfactory and unattended by any serious troubles of any kind. The methods employed in the manipulation and treatment of the coal have not only eliminated the usual breakage, but have substantially increased the market value of the fuel prepared.

A Special Coke Number

The June 7 issue of COAL AGE will be devoted principally to the subject of coke manufacture. We will be pleased to receive articles and discussions dealing with some phase of the coke business from any of our readers. All matter for this particular issue of COAL AGE should be in our hands within the next week.

The Kentucky Mining Institute

The papers presented before the summer meeting of the Kentucky Mining Institute, held in Lexington, May 16-17, will be printed in our next issue of COAL AGE. A detailed account of the First-Aid Field Meet also will be published in our next number. It is safe to say that this most recent meeting of Kentucky coal men was the most enthusiastic and the best attended coal conference ever held in the State of Kentucky. The Continental Coal Corp. deserves particular mention for the vigorous support it rendered the Institute. The Continental people came to the meeting in a special train, with a brass band and all the other essentials needed to create plenty of enthusiasm.

American Coal in France

United States Consul General Frank H. Mason, stationed at Paris, says:

The year was marked by a notable advance in the prices of both coal and coke, so that some apprehension has been felt about future supplies of fuel for the iron and other industries. The price of coke for the metallurgical industries is fixed by agreement between producers in the Pas-de-Calais district and the blast furnaces in the east, and is revised every three months. The rates for the four quarterly periods of 1912 were as follows per metric ton of 2204.6 lb.: First quarter, $4.137; second; $4.194; third, $4.415; fourth, $4.697. This shows a net increase during the year of 56c. per ton.

EDITORIALS

The Miners' Opportunity

During the past few years much attention has been drawn to the various vocational mining schools being established throughout the country, and particularly in the anthracite region. Here the trapper boy, the driver, the laborer, miner and foreman meet upon a common level for mutual improvement. Nor is it uncommon to find the men in the inferior positions showing greater aptitude for, and improvement in, their studies than those higher up.

We have heard much of the hopelessness of labor and the inability of the laboring man to rise above his environment. These men should remember, however, that with the vocational schools and the mining institutes at their very doors, it is strictly "up to them" whether they shall remain in their present humble circumstances or shall succeed to positions of responsibility and profit in the mining industry. Surrounded by present-day oportunities, they and they alone are the masters of their own destinies.

Ohio's Proposed Anti-Screening Law

The determined and partially successful efforts that are being made to push through the Green "Run-of-Mine" bill in Ohio, in the face of numberless irrefutable arguments against it, furnishes conclusive evidence of another power in the political arena—the enormous and far-reaching power of organized labor. There was, of course, a time when corporations assisted in the election of men whom they could depend upon to at least protect their interests, but under pressure of public opinion they have been gradually forced to withdraw.

In the case of labor, the public is disposed to be more sympathetic and the unions are showing a prompt appreciation of the advantage and possibilities of this leniency. Class legislation is being enacted in all parts of the country, which is not only interfering with the management, but is destroying discipline and must eventually deplete the revenues of the industries affected. Labor's position differs from that of the corporation's only by delivering the votes instead of the money with which to buy them, and a candidate must declare himself or be branded as a "foe to labor" and suffer an ignominious defeat.

A brazen example of labor legislation is shown in a bill recently introduced in the New Jersey legislature, prohibiting railroads from testing their signals without first warning the locomotive engineers that such tests were to be conducted. It seems to have been the practice of the Pennsylvania R.R. to make tests of this character at intervals and of some 51,000 made in 1912 it was found that the enginemen failed to observe the signal in 510 cases.

Presumably each of these might have resulted in a fearful catastrophe and yet these men deliberately and unblushingly resent being disciplined and demand to be exempted from tests of their alertness and ability even though thousands of the traveling public are daily dependent upon these qualifications for their very lives. The "service bill" in Pennsylvania is an equally ridiculous and reprehensible measure, while the ultimatum delivered by the president of the Firemen's Brotherhood to the railroad managers that: "If we don't get it here, you can depend upon it we will get it in Washington" is particularly significant.

The Ohio screening bill is obviously a labor measure, headed by a labor leader and strongly supported by a labor party. It shows a determination on the part of the unions to gain their ends at a sacrifice of every other consideration and the people of Ohio would do well to study the effects of a like measure on the coal industry of Arkansas before idly conceding. The screening bill there went into effect in 1905. During the succeeding five years, to and including 1910 (the banner year in the coal industry for which any authentic returns are so far available), the coal production of the United States increased 28 per cent. During this same period Ohio's tonnage increased nearly 35 per cent., while that of Arkansas showed a slight *decrease*. The results are too obvious to require any comments.

The West Virginia Settlement

The Paint Creek mine-strike is settled, at least for a time, and we are not much surprised that an increase in wage is not among the provisions. The miners of West Virginia have been able to earn a fair living out of the present schedule, though it is lower on the actual tonnage basis than that obtaining in Pennsylvania and other states. This has been due to their steadier effort and to the fact that the coal is, for the most part, easier to dig.

But even if these statements were not true and the income from labor of the West Virginia miner were abnormally low, nevertheless we hardly think the Union, if firmly established, would be able to raise the wages of the miner in that state appreciably.

It has been always found that differentials were hard to correct because the interests of the operator and his employee and of the railroad transporting the coal are identical. Disturb the differential and the change in rates will reduce production in some other field; the railroad in that field as well as the operator and employee will be idle. So that real modifications of the balance are rarely effective whether decreed by courts or unions.

The Springfield, Ill., operators are raising a purse to seek lower rates from the commerce commission. If they succeed, other reductions will occur elsewhere and the differential will continue. The same condition is true of West Virginia in regard to wages. To raise the ton or day wage paid to miners and mining men will put West Virginia at a disadvantage in the market and in that misfortune, the workingman will suffer with the rest.

There was a time when wages could have been raised to a higher level in West Virginia, but that time has passed. The coal has worked its way into too closely competitive markets and the industry has grown accordingly, with the result that the lower wage is not merely needed to enter new markets but to retain those already secured.

It is foolish to believe that a Union could raise wages in a state where the ability of the operators to produce coal so largely overweighs their power to sell it. The Union and the operators have always acknowledged differentials where they existed and will be obliged to do so in the future. Labor is largely immobile and this fact prevents the actual compensation being nicely adjusted to the labor of mining. Men will not move from state to state for a trifling differential and when this difference is as much apparent as actual, the appeal is not enough to induce workingmen to migrate. So despite the lower wage the miner decides not to take "his beef and brawn" to the better market, and the price of his labor is fixed at the level which will permit the operator to conduct his business and meet the competition of all the fields into which his coal enters.

If labor was freely migratory, the lower-tonnage rate would years ago have caused the miner to move north and west. He would then have compelled the operator to raise the wage rate and the market of West Virginia would have been limited to its boundaries on three sides and to Virginia and the Atlantic Coast on the east. Labor did not migrate and West Virginia coal is found everywhere.

Nothing but a pronounced exodus can cause the operator to give higher rates than he now pays. If the miners would all have work and stay in the state, they must enable the operators to continue to ship coal to all points to which it is now being consigned by signing a wage scale like that now obtaining.

It is needless to add that the increase of wage cannot well come from the profits of the operator. West Virginia has been over-exploited like almost all of the American coal fields. Dividends in that state are hard to obtain and many are the concerns which cannot earn them or even "coax" a favorable balance on their books. The struggle between the operators of the state is now keen and profits are not made as freely as 15 years ago.

If the burden of a wage increase is to be laid anywhere, it might be placed on the royalties paid by the operators, but in any event such an increase would necessarily be small.

The Other Man's Way

The coal fields of America are operated in a number of exceedingly varied ways. It is remarkable that in a country with an active technical press, with railroads and mails highly developed, there is so much provincialism.

All our readers want a paper which will detail the plants in their own neighborhood—the mere chit-chat of local development. They do not know or care to know what is being done in remoter coal regions.

Yet the history of their own future mining methods is being written in these distant places. The State of Illinois, for instance, with increasing output and many new mines, is developing new standards—light steel headframes, fireproof yet not unreasonably expensive. It is adopting the electric hoist and largely using the recording scale. Some of its operators openly declare that the Eastern bituminous fields are effete and have set themselves largely against progress, but one can readily see where a trip East would reveal many new ideas which would revolutionize mining in the Middle West.

Our coal-mining institutes are doing valuable work in helping to bring the less modern mines of districts up to the level of the best, but these organizations are purely local. They do not broaden the minds of their members as such institutions should.

It is for this reason that we welcome the trip the Coal Mining Institute of America is about to make to Wilkes-Barre. It is well known that this body consists mainly of western Pennsylvania mining men, whose vision has been largely circumscribed by the Chestnut Ridge and the boundary lines of the western part of the state. There is a great need that all the institutions be widened by the travel of their members, and in no way could this end be obtained more successfully than by the welding of these smaller units into a common national body.

Relative Fatality Rate in Coal and Metal Mines

Albert H. Fay, at the recent meeting of the New York Section of the American Institute of Mining Engineers, declared that if the coal mines worked with the regularity of the metal mines, the fatality rate of the former would be higher than that of the latter.

But the method of calculating working days is perhaps not exactly parallel in the metal- and coal-mining industries. Mr. Fay declared that many of the companies reporting from the West, represented themselves as working 365 days, doubtless because every day some men were in the mine; the operations of timbering, laying track and repairing, proceeding briskly when the mines are idle.

The method of calculation favored by many metal-mine operators, has not found favor in the coal industry, the tendency being to record only the days when the mine is officially said to be running. In many mines when business is slack, much coal is undercut and shot down, not a little coal is hauled, and some is often actually dumped into the railroad cars on what are termed idle days; the tonnage being credited to the next official day.

Both the records of the Bureau of Mines and the Geological Survey relative to days worked are, we are assured by Mr. Fay and Jefferson Middleton, duly weighted so that the idleness of a small mine does not have appreciable effect on the estimated average, whereas the shutting down of a large mine has a much greater effect.

But the records received from the mining campanies by these bureaus, while properly manipulated when presented, are not constructed by the reporting companies with due regard to scientific principles of reckoning. The results are, therefore, not entirely reliable, and if the truth could ever be known, it is probable that the small 11 per cent. margin, against the coal operator, would be shown to be the result of a variance in the method of calculation of the number of working days.

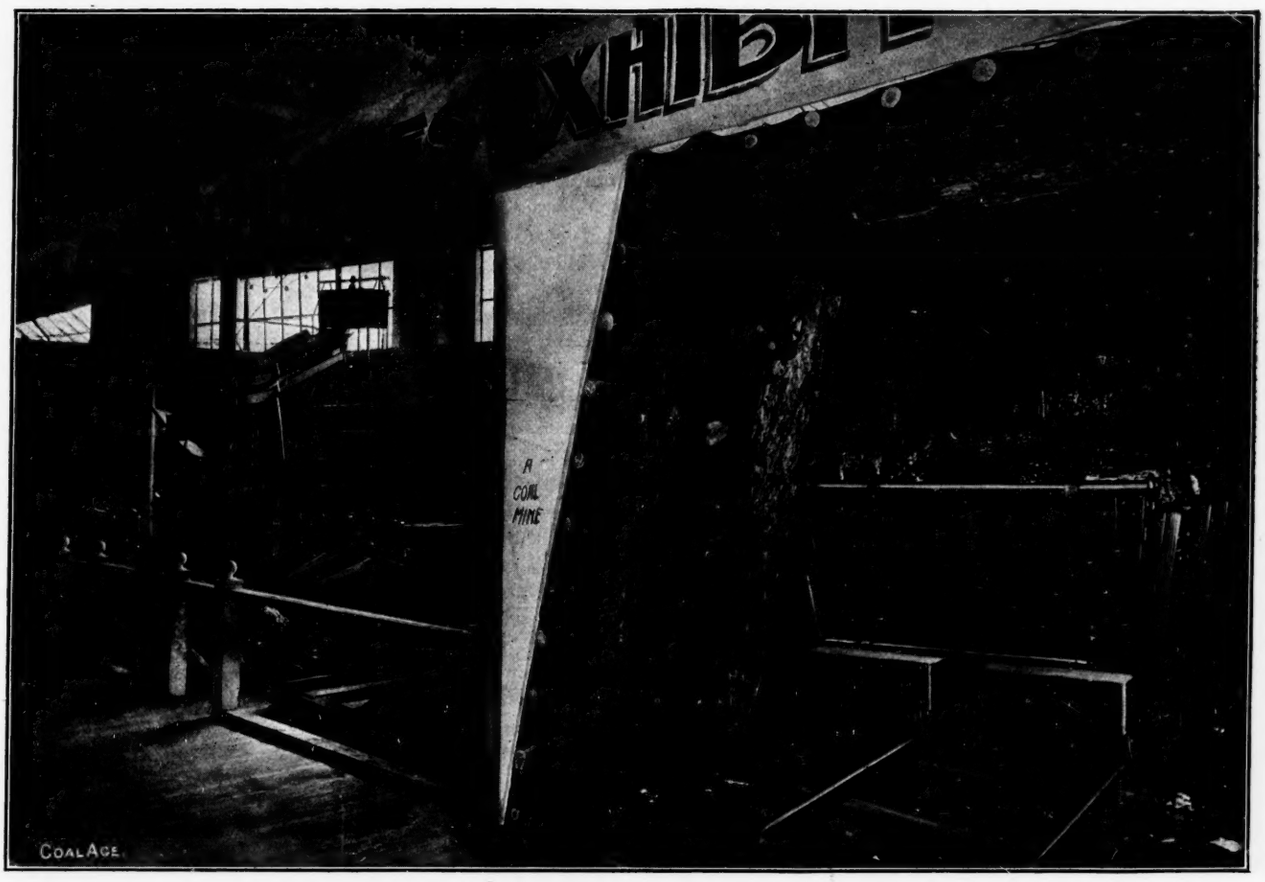
It remains a fact that the annual death rate of coal miners is 12 per cent. less than that of metal miners and, that thanks to the bureau amid many other agencies, the death rate is, at least, at present decreasing.

The Wilkes-Barre Industrial Exposition

The Greater Wilkes-Barre Industrial Exposition was held in the new Penn Tobacco Co. Building, on S. Main St., Wilkes-Barre, Penn., May 10-17, inclusive. The exhibits were displayed on the first and second floors, occupying a total space of about 24,000 sq.ft., while the third floor was used for concerts, etc. The total number of exhibitors was in the neighborhood of 112, while the materials displayed included everything from heavy mine machinery to a peanut stand.

The most interesting features of the exposition were in the display by the coal companies. To this the Lehigh Valley Coal Co., the D., L. & W. Coal Department, the D. & H., the Lehigh & Wilkes-Barre Coal and the Susquehanna Coal Co. contributed jointly. This exhibit included the demonstration of the first-aid rescue work, preparation of anthracite coal, pyramid of coal eight feet high, fossil tree weighing two tons, undercutting machine and all kinds of miner's and safety lamps, all sizes of coal and the face of a timbered gangway with a loaded car on the track.

The length of the gangway was about thirty feet and the timber was covered with tarred paper or similar black material, so that the whole room was made dark, while the face appeared to be a solid mass of coal, eight feet high, with a six-inch slate band, four feet from the bottom. It was built with lumps of coal, each about one cubic foot in size and mortared with a black cement. A dummy was placed at the face to represent a miner about to drill a hole. So realistic was this representation that a boy, after examining the face, remarked to his father: "This is really and truly a coal mine!"



PART OF THE COAL COMPANIES' EXHIBIT AT THE GREATER WILKES-BARRE INDUSTRIAL EXPOSITION

MACHINERY EXHIBITS

The Vulcan Iron Works displayed a mine locomotive which was new and looked very attractive. It was so placed that a visitor could examine all its parts without bending or stooping. The Hazard Wire Rope Co. exhibited a machine drawing copper wire and insulating the same.

The Howells Mine Drill Co., of Plymouth, Penn., exhibited an electric coal drill. This outfit consisted of an electric drill, Spry type "S," and a 10,000-lb. lump of anthracite coal, obtained from one of the D., L. & W. mines, in Plymouth. This coal contained, roughly, 110 cu.ft., being a 4.8-ft. cube. The electric drill was mounted in front of the coal with a 1½-in. bit, and current was turned on. The machine actually drilled at the rate of 7 ft. per minute.

To drill a 7-ft. hole with a hand apparatus requires at least 30 min. In other words, the electric drill works thirty times faster than the ordinary hand machine. The motor requires about 15 amp. at 220 volts, direct or alternating current. The weight of the complete outfit with post is 275 lb., and the cost $275, or one dollar per pound. There are now about 300 of these electric drills used in the anthracite region. They are also being employed in salt, gypsum and talc mines.

DISCUSSION BY READERS

Education in Coal Mining

Letter No. 18—Education, in its broadest sense, includes such instruction and discipline as is intended to enlighten the understanding, correct the temper, cultivate the taste, form the manners and habits, and fit persons for usefulness in their future stations. Education is as necessary in coal mining as in any other industry. Every man and youth needs all the education he can get, and the amount of good he will derive from it will depend upon himself.

A systematic study will bring good results, if properly applied to everyday conditions; but a spasmodic effort to get, in two weeks time, the knowledge that should require two years to obtain, can result only in final failure. Compulsory school laws will tend to keep many boys away from the mine; education will turn many to other occupations. As a natural result, the future of coal mining must depend on imported foreigners, who must be educated and trained how to mine coal properly, and how to protect themselves and the property of their employers.

The education that is mostly needed in coal mining is the kind that applies to the actual working conditions, and teaches the miner how to properly mine and shoot his coal, timber his working place, handle and load cars, and many other things that will insure his safety and economize time, labor and material.

My advice to every coal miner is: "Be ambitious; get all the book learning you can by reading and studying coal-mining books and journals. Do not crowd your head with formulas and neglect other things more important. Try to apply what you read to the actual conditions with which you are familiar. Make good use of your spare time and idle days. Consider the work in the mine as a course of educational training and study how the work can be done in the best, safest, cheapest and quickest manner. Observe closely all that is done in the mine, and, when possible, ask to have explained what you do not understand.

The question of deciding the character of mining examinations is a very broad one and can be looked at from many different sides. I think that only such questions should be asked as relate to the actual work and conditions that mine foremen and firebosses have to meet in the mine and the problems they must solve. Sometimes, questions are asked at examinations that are entirely out of place and, in actual practice, would be handled by one of the engineers rather than by the foreman.

Handbooks and textbooks are written by experts and authorities, and their purpose is to aid the worker and save his time. If a man understands the principles taught and has the intelligence to use a handbook correctly he will use it in actual practice; and the examination should b made to correspond to that practice, as nearly as possible. A mine worker going before an examining board is naturally anxious and excited. He fears and forgets; his hands are used to toil and it is hard for him to write fast and long. Therefore, I believe more stress should be laid on oral questions and less written work should be required of the candidate. In this way, the examiners would be able to draw out many good points that the candidate would forget to write.

Proper weight should be given to a man's experience and his personal and moral record. It frequently happens that certificates are granted to young men who are wholly incapable of running a mine and have not had the actual experience in gaseous mines; but who, by stretching the truth, are able to pass a creditable examination. A man's experience in gas should be verified. I am in favor of giving the mine worker every educational advantage possible, morally, physically, intellectually and sociologically; but, by all means, be square with him; and do not expect of him the attainments of a student or a college-trained man.

MINING ENGINEER.

Clarksburg, W. Va.

Letter No. 19—The necessity of requiring candidates for the position of mine foreman or fireboss, to undergo an examination and obtain a certificate of competency from a duly authorized examining board has been demonstrated as a wise provision. Mining today requires the services of men who have more or less technical training; but the man who blends both practical and technical experience and training is in greatest demand. The method of obtaining technical training in almost any line or industry is not denied any ambitious person today. Educational methods are made clear and concise, and the course of study much shortened by presenting only those parts of subjects that are necessary for the particular work in hand.

While there are some ambitious, energetic young men with means sufficient to obtain a thorough technical training, it cannot be denied that many of this class would have received greater benefit by going to work in the mills, mines, or on the farm than by going to college. There are, on the other hand, many thousands of men whose schooling has never gone beyond the eighth grade; and this, in many cases, has only been accomplished by the passage of the law prohibiting children under 14 years of age, in some states, and 16 years of age in Montana, from working in the mines. Few of these men realize they have much to learn until they have reached the age of 30 or 35 and sometimes 50 years.

A Chinaman in Butte City, Mont., took a course in land surveying, at 60 years of age, and successfully completed it. While men of advanced age, however, have generally lost the faculty of memorizing formulas, constants and other data, it is not difficult for them to learn to select and apply the proper formula required for the solution of any problem. The engineer, although a college-trained man, refers constantly to his handbook for such formulas, constants and data. The practical mine foreman, in the same manner, uses his handbook to work out any mathematical problem connected with his work.

Such a man is a more competent man in the mine than the college-trained man, who seldom has any practical experience.

I recently discussed the subject of examinations with a general manager of coal properties in Canada, who was himself a college-trained man but, later in life, gained considerable practical experience and understood well what was required of a good mine manager. This man remarked that, in Canada, the examinations were running more to the academic than to the practical; and that, on this account, good mine managers were becoming scarce.

When the mining law requiring the examination of mine foremen and firebosses in Montana was being drafted I asked those who had charge of the bill to incorporate a provision allowing the use of textbooks in the examinations, explaining that it would be a benefit to the practical man and that, by suitable regulations in respect to the character of the examination, it would give no advantage to the college-trained man. On the other hand, the practical man with some technical training would thus become a dangerous competitor of the technical man who had little or no practical experience.

Education is a valuable asset, more so to the man who works during the day and studies at night to acquire knowledge. Such a man is of more value to a company than any walking encyclopedia who can reel off formulas, constants and other data, without reference to textbooks. In the performance of difficult mining work, I very much prefer to employ the engineer who refers to his textbook in preference to the wiseacre who quotes from memory.

The use of textbooks, in examinations before county boards in Montana, is safeguarded, as the books are only allowed for certain purposes, and this law is working satisfactorily. I believe less harm will result in allowing the use of textbooks to enable the practical miner to pass an examination for mine foreman or mine inspector than would result if many of these men were debarred on account of their inability to memorize formulas. In such an examination the college-trained man certainly has an advantage, because he can more easily remember the data and formulas he needs in the examination.

It is my experience that the use of textbooks, in this manner in examination, does the technical man no harm, while it places the practical man of limited technical training on the same basis on which he is accustomed to work in the office or at home. In other words, it gives the practical man an opportunity to show his ability to handle this class of work in connection with his other duties. It would not make him a better man if he could remember the data and formulas he is accustomed to find in the textbook.

JOSEPH B. MCDERMOTT,
Chief Mine Inspector.

Helena, Mont.

A Suggestion

The practical man has a hard road to travel; and there should be some means adopted that would require him to increase his education along certain lines. It might be that an examination at certain periods would solve this question. Mining journals should give this matter careful consideration.

A MINE SUPERINTENDENT.

Johnstown, Penn.

Carelessness the Cause of Many Mine Explosions

Since I have been a reader of COAL AGE, many articles have appealed very strongly to me, especially those treating on explosions of gas or dust.

In the year 1888, Jan. 24, I was in an explosion at No. 5 mine, Wellington, B. C., Canada, where 97 men lost their lives. Eight months previous to this No. 1 mine at Nanaimo had exploded, causing the loss of 137 men. I was a witness of the terrible effects of these explosions, both of which were ascribed to coal dust ignited by blownout shots. I know gas was often found in each of these mines and I believe that in the explosion gas was disturbed and brought down on the naked lights by the blownout shots. I believe also the explosion was augmented by the coal dust blown into the air by the force of the blast. However, comparatively little was known then of the danger of coal dust in respect to mine explosions. In these cases the coal seam was irregular, measuring in some cases 16 and 20 ft. in thickness, while in other cases the coal would run out to 2 and 3 ft. in thickness. This condition interfered considerably with the proper ventilation of the mine.

I feel the coal industry deserves greater consideration by scientific men than it has received in the past; and I am glad to see that such men are applying themselves to a careful study of this subject. I believe that greater care should be taken by mine managers generally in the selection of workmen in mines where gas is encountered, and coal dust is known to be a source of danger.

I recall an instance that occurred when I was employed in an entry where several stalls were turned off and the only means used to conduct the air past these stalls into my place was a brattice cloth. I found gas in my place and went out to ascertain the cause, when I discovered a man with a curtain propped up while he was loading a car. I pushed the car ahead and dropped the curtain. Going back to my place, it was not long before the condition was as bad as ever. Going out again, I found the man working as before with the curtain up. It is true he was rather cramped for room to fill the car with the curtain down, and sooner than put up with that inconvenience he was willing to run the risk, and endanger the lives of every man in the mine.

I reported this incident to the fireboss, but it did not seem to impress him as a matter of importance, and I left the mine at once. I could not leave the camp, since a washout had occurred on the railroad, and while I was waiting for transportation, the most disastrous explosion ever experienced in British Columbia occurred at No. 2 mine, Fernie, May 22, 1902. I was at Michel. The superintendent there called for volunteers to go to Fernie. With others I answered the call and worked four days in the efforts to rescue the men in that mine.

I think this and similar accidents, which are of everyday occurrence, show that it is of the utmost importance in coal mining that careless workmen should be eliminated and kept away from the mines. I admit there are difficulties in accomplishing this, but claim it should be the constant effort of mine managers to secure a force of careful workmen.

AMOS GODFREY, MGR.,
B. C. Anthracite Coal, Ltd.

Vancouver, B. C., Canada.

Appointment vs. Election of Mine Inspectors

Referring to the editorial on "The Anthracite Mining Code, COAL AGE, May 10, p. 733, permit me to add that the chief objection urged against the appointive system, in the selection of mine inspectors, is that this system places in the hands of a single person, generally the governor of the state, the power to appoint any person he may choose who fills the requirements of the law in this respect. If this were true, and it is in some states, the objection would be an important one, since it would inaugurate the "spoils system," which is opposed to civil-service practice, which should always control the selection of mine inspectors. All will agree that the office of inspector of any nature, mine inspector, boiler inspector, building inspector, etc., should be entirely disassociated from the spoils system, in order that the work of the inspector may be efficient, and that he may be untrammeled as an officer of the law, in the difficult work he has to perform.

Referring to the appointment of mine inspectors, the law recommended by the majority of the anthracite-code commission (Art. 9, Sec. 1), provides that the governor shall appoint a mine inspectors' examining board, consisting of four mining engineers and five miners, whose qualifications are specified in the law. The law further specifies the time and character of the examination and the qualifications of the applicant, and requires that the successful candidate must obtain at least 90 per cent. in the examination. The law provides that at least six of the nine members of the board shall certify to the governor and also to the chief of the Department of Mines the names and percentages of the candidates who passed a successful examination.

Then follows Sec. 6, which reads:

The governor shall, from the names certified to him by the examining board, commission a person or persons having the highest percentage in the examination, to be inspector for each district where a vacancy exists.

The advocates of this provision of the law claim that, since the governor must appoint the candidate or candidates receiving the highest percentage in the examination, he is not free to appoint the man of his choice. It must be remembered, however, that, in accordance with Sec. 1, the governor appoints also the examining board, which lays the law open to the previous criticism, giving the governor the supreme power that is always objectionable. To avoid this difficulty, the district court should be made to appoint the examining board, while the governor is authorized to appoint, as inspectors, and commission those candidates receiving the highest percentages in the examination.

A READER.

Pittsburgh, Penn.

Study Course in Coal Mining

BY J. T. BEARD

The Coal Age Pocket Book

MECHANICS

Mechanics is that branch of science which treats of the action of force on matter.

Force—Force is an indescribable agency that acts on matter and changes or tends to change its condition or state with respect to rest or motion.

Statics, Dynamics—There are two general divisions of the subject, which may be defined as follows: 1. Statics includes all cases in which force acts on a rigid body and no motion results. 2. Dynamics relates to the action of force on bodies free to move and motion is produced.

Measure of Force—A force is measured in either one of two ways, according to the conditions under which it acts or the results produced. In statics, the action of the force produces pressure only, and this pressure is the measure of the force expressed in ounces, pounds, hundredweight, or tons.

In dynamics, the unit of measure is a force capable of producing a unit velocity in a unit of mass. The moving force, in any given case, therefore, is expressed by the product of the mass (m) of the body and the velocity (v) produced. This moving force is sometimes regarded as imparted to the body when it is called the "momentum" of the body.

Gravity—The force of gravity is the most universal force in its manifestation and, for this reason, its effect is made the basis for the measurement of all forces both in statics and dynamics. Gravity is the attraction that every particle of the mass of the earth exerts on each particle of the mass of a body. This attraction is greatest at the surface of the earth and decreases above or below sea level.

Weight—The action of gravity on bodies produces weight. The generally accepted unit of weight is the pound. Since gravity acts equally on each particle of the mass of a body, the weight (W) of the body is proportional to its mass (m) and the force of gravity (g), as expressed by the formula

$$W = mg$$

The pound is the static unit of measure, it is the amount of the force of gravitation that acts on a certain prescribed mass, at sea level.

Mass—The mass of a body is expressed by the quotient obtained by dividing its weight, in pounds, by the value of the force of gravity at sea level, as expressed by the formula

$$m = \frac{W}{g}$$

Value of Gravity—The value of gravity is determined by the gain, each second, in the velocity of a body falling in a vacuum. This value varies with the latitude of the place and the elevation, and is expressed in feet per second. It has been carefully determined by a number of experiments.

The Coal Age Pocket Book

Theoretical Velocity—When a body falls freely in a vacuum there is no resistance to its fall; and the force of gravity (considered as constant for the distance of fall) acts on each unit of the mass of the body to increase the velocity of its fall. At sea level, New York, lat. 40°, the force of gravity produces an increase in the velocity of a body falling in a vacuum, of 32.16 ft. each second. This is called the "theoretical velocity" of a falling body; because, in practice, the resistance of the air is always present and reduces the gain or increase per second.

Body Falling from Rest, in a Vacuum—If the body falls from rest, in a vacuum, its velocity is zero at the beginning of fall and 32.16 ft. per sec., at end of 1 sec. The average velocity for the first second is therefore ½ (32.16) = 16.08 ft.; and the distance of fall in the first second is also 16.08 ft.

For two seconds, the gain in velocity is 2 × 32.16 = 64.32 ft. Falling from rest, the velocity at end of 2 sec. is 64.32 ft. per sec. The average velocity for the 2 sec. is ½ (64.32) = 32.16 ft. per sec.; and the distance of fall for two seconds is therefore 2 × 32.16 = 64.32 ft.

For three seconds, falling from rest:

Gain in velocity	= 3 × 32.16	= 96.48 ft. per sec.
Velocity at end of 3 sec.	= 0 + 96.48	= 96.48 ft. per sec.
Average velocity for 3 sec.	= ½ (96.48)	= 48.24 ft. per sec.
Distance of fall in 3 sec.	= 3 × 48.24	=144.72 ft.

In like manner, for a body falling from rest, in a vacuum, the total gain in velocity is the final velocity at end of fall; the average velocity is one-half the final velocity; and the distance of fall is the average velocity multiplied by the number of seconds of fall; thus,

Time of Fall, in Seconds	Gain in Velocity Each Sec.	Total Gain or Final Velocity	Average Velocity in Ft. per Sec.	Distance of Fall, in Feet
0	.....	.....	.....	.....
1	32.16	32.16	16.08	16.08
2	32.16	64.32	32.16	64.32
3	32.16	96.48	48.24	144.72
4	32.16	128.64	64.32	257.28
5	32.16	160.80	80.40	402.00
10	32.16	321.60	160.80	1608.00

Formulas for Theoretical Velocity—The formulas expressing the final velocity (v), of a body falling from rest, in a vacuum, under the influence of gravity (g = 32.16 ft. per sec.); and the height of fall (h); for a number of seconds (t) are as follows:

Final velocity, $v = gt$ (1)

Average velocity, $\frac{v}{2} = \frac{gt}{2}$ (2)

Height of fall, $h = \frac{gt}{2} \times t = \frac{gt^2}{2}$ (3)

Time of fall, $t = \sqrt{\frac{2h}{g}}$ (4)

INQUIRIES OF GENERAL INTEREST

Removing Gas by Boreholes

A difference of opinion existing, we desire to submit the following question relating to the drainage of gas accumulated in abandoned workings that have been sealed off with air-tight stoppings:

The surface is of a hilly nature; a 6-in. borehole 900 ft. in depth has been drilled from the surface to tap a body of pure marsh gas accumulated in an abandoned section of a mine. The gas is dormant, by which is meant there are no feeders producing a fresh supply of gas. The abandoned section is entirely isolated from any other part of the mine and does not get any air from the mine workings. Owing to the depth of the workings below the surface, the difference between the atmospheric pressure at the surface and that in the mine is 1 in.; or, say the pressure on the surface is 23 in. of mercury when the pressure at the bottom of the shaft is 24 in. Will this borehole remove the accumulation of gas in the abandoned area under these conditions? The only vent is through the drillhole to the surface.

JAMES W. GRAHAM,
Deputy Mine Inspector.

Lafayette, Colo.

The question states that the place is sealed off with air-tight stoppings, and the only vent is through the drillhole to the surface. Therefore, no air can enter or leave this section except through the drillhole.

There are two conditions that would give rise to a slight or gradual interchange of the gas below and the atmospheric air at the surface: (1) The atmospheric air is generally cooler and therefore heavier than the mine atmosphere. (2) The "pure marsh gas" (CH_4), being much lighter than air, will tend to rise as fast as it is replaced by the heavier air at the surface.

The interchange of the gas below and the air at the surface will be very gradual at the best, owing to the great depth of the hole. There would probably be no perceptible current, either up or down, in the drillhole. The conditions named, however, would operate slowly to change the gaseous condition in the abandoned section, but the change would be too slow to be of any practical benefit in draining off the gas.

In order to drain the gas from the abandoned section, in this case, it would be advisable to insert a pipe provided with a stop-cock, in one of the sealed stoppings. Observations should be taken, from time to time, to ascertain any movement of air or gas through this pipe. If the blowing system of ventilation is used in the mine, the mine air will always escape through the pipe into the abandoned section and drive out the gas, which would then pass up through the drillhole to the surface. If, on the other hand, the exhaust system of ventilation is employed, the gas accumulated in the abandoned section will be forced by the pressure of the atmosphere exerted through the drillhole, into the mine workings whenever the stop-cock is open in the pipe.

Hoisting from Two Seams

What kind of an engine must we install to hoist coal from two veins in the same shaft? The first vein is 70 ft. below the surface and the second vein is 105 ft. lower, making the total depth of the shaft 175 ft. Should we use a friction clutch on the drum, or should the drum be keyed to the shaft?

ENGINEER.

Calvert, Texas.

For this depth of shaft (175 ft.), a geared engine, sometimes called a second-motion engine, should be used. In deep shafts, say where the depth exceeds 75 or 80 yds., a higher speed of winding must generally be used; and for that purpose a direct-connected or first-motion engine is generally preferred. In shallow shafts, the geared engine gives a better control of the hoisting operations and permits a heavier load being hoisted.

In order to hoist from two separate seams, a double drum must be used, one portion of which is movable on the shaft and supplied with a friction clutch by which it can be made fast to the other drum or to the drum shaft. This arrangement will permit the relative position of the cages in the shaft to be changed when it is desired to hoist from another seam.

For example, suppose it is desired to stop hoisting from the lower seam and start to hoist from the upper seam. When hoisting from the lower seam, one of the cages is at the landing in that seam when the other cage is at the tipple landing. Now, to change the relative position of these cages, it is only necessary to apply the brake firmly to the movable drum, thus securing the cage at the upper landing, and, having loosened the friction clutch holding that drum to the drum shaft, hoist the other cage to the landing at the upper seam, and again apply the friction clutch. The cages are now in position to hoist from the upper seam.

❖

Percentage of Gas in Air Splits

If an air current containing 9.5 per cent. of gas and measuring 30,000 cu.ft. of air per minute, is divided at the regulator so that one split passes 10,000 cu.ft. per min., and the other split 20,000 cu.ft. per min., what percentage of gas is there in each of these splits, and what quantity of gas is passing in each split per minute?

STEPHEN STRANCH.

Helen, Penn.

Assuming the gas is evenly distributed in the air current, it will be divided in the same proportion in which the air is divided and there will be the same percentage of gas (9.5 per cent.), in each of the splits, as was found in the main air current before it was divided.

The quantity of gas in the first split is $0.095 \times 10{,}000 = 950$ cu.ft. per min.

The quantity of gas in the second split is $0.095 \times 20{,}000 = 1900$ cu.ft. per min.

EXAMINATION QUESTIONS

Bituminous Firebosses' Examination in Pennsylvania, May 8, 1913

Ques.—On entering a mine as fireboss, how would you discharge your duties as such, and what information should you obtain before beginning the examination in the mine?

Ans.—Assuming that the fireboss has properly cleaned, filled, trimmed and tested his lamp before entering the mine, his first duty is to proceed at once to the main intake airway in order to ascertain whether the usual amount of air is passing into the mine. Before entering the mine, the fireboss should always ascertain that the fan is running at the usual speed and that the proper danger signals are set at the mine entrance to prevent anyone from entering the mine while he is making his examination. The fireboss then proceeds to the intake of the section of the mine in his charge and examines, in regular order, the working places in that section.

Ques.—What are the legal duties of a fireboss? State briefly.

Ans.—The bituminous mine law of Pennsylvania requires the fireboss to examine carefully, within three hours before the appointed time for the men to enter the mine, every working place without exception; all places adjacent to live workings; every roadway and every unfenced road leading to abandoned workings and falls in the mine; and to examine for all dangers in all portions of the mine in his charge; and to mark the date at the face and side of every place examined, as evidence that he has performed this duty. He must examine the entrance or entrances to all worked out and abandoned portions adjacent to the roadways and working places, where explosive gas is liable to accumulate; and place a danger signal across the entrance to every place where explosive gas is discovered or danger is found to exist. In making his examination, he must use no other light than that of an approved safety lamp. It is the duty of the fireboss to explain all danger signals to the non-English-speaking employees of the mine, through an interpreter, in their own language.

The law requires the fireboss to enter in a book kept at the mine for that purpose, a record of his examination, in ink, and sign the same immediately after the examination is made. This record must show the time taken in making the examination and state the nature and location of any danger found, which danger must be then immediately reported to the mine foreman. He must notify the mine foreman, or assistant mine foreman, by telephone, or otherwise, that the mine is in safe condition for the men to enter. Where the record book is kept at a station in the mine, the fireboss must also sign the report made in the book kept in the office on the surface. The law requires that a second examination shall be made by the same or other firebosses during the hours when the men are at work. The mine foreman and the fireboss must provide a permanent station with a proper danger signal designated by suitable letters and colors, at or near the main entrance or entrances to the mine.

Ques.—Give six essential features of a safety lamp for testing purposes.

Ans.—A good lamp for the purpose of testing for gas and examining the mine for other dangers must not only be (1) simple in construction and sensitive to gas, but must be (2) capable of giving a good light when required. In order that the lamp shall be sensitive to gas, (3) the air should enter the lamp at a point below the flame and circulate upward through the combustion chamber. The lamp should be (4) provided with a double-gauze chimney that will permit of a free circulation of the air in the lamp while, at the same time, giving the needed protection in the upper part of the lamp. The lamp should be (5) provided with a suitable bonnet or shield, such as to protect the lamp against strong air currents or blasts of air, without unduly restricting the circulation in the lamp. The oil burned in the lamp should be such as (6) to give a constant flame that does not incrust the wick or cause the lamp to heat rapidly in gas. A pure sperm, or cottonseed oil, is better adapted for testing than a volatile oil. because the latter volatilizes more rapidly as the lamp heats in gas and gives unreliable results in testing.

Ques.—Who should be intrusted with a safety lamp, and when and where should you use safety lamps in bituminous coal mines?

Ans.—A safety lamp should only be intrusted to a competent person—one who has shown that he understands its use and can be relied on to exercise proper judgment and discretion in its handling and use. A safety lamp is never safe except when properly handled by a competent person.

Safety lamps should be used exclusively, in mines generating gas in sufficient quantity to be detected on the flame of a common Davy lamp, or where the condition at the working face, with respect to the generation of gas and the circulation of air, is such that gas can be readily fired at the roof or at the immediate face of the coal. In the present status of coal mining operations, it is not safe to work, with open lights, such places where the lamps must be kept at a safe distance below the roof and away from the face of the coal. The only exception to this rule may be at the anthracite mines, where coal dust is not as dangerous a factor in the production of an explosion.

It is not safe to work any bituminous coal mine with mixed lights, since any unforeseen occurrence in the safety-lamp section, such as a fall of roof or a slight derangement of the ventilating system, may precipitate a dangerous condition in the open-light section of the mine.

Ques.—Where should safety lamps be filled and trimmed before being given to the workmen?

Ans.—All safety lamps should be properly cleaned, examined, filled and trimmed in the lamp house before they are delivered to workmen.

COAL AND COKE NEWS

Washington, D. C.

T. P. MacDonald has filed with the Senate Committee on Territories a recommendation for dealing with the coal situation in Alaska which embodies the following suggested propositions:

First. Limit the ownership or control of any coal company to 4 or 6 sq.mi., or such acreage as may be deemed sufficient.

Second. Fix adequate penalties to prevent combinations to control output or prices.

Third. Empower the Interstate Commerce Commission or some other competent court to make thorough investigation and fix minimum and maximum prices upon a proper showing by either a coal producer or a coal consumer and thus prevent the crushing of independent operators by their more powerful rivals on the one hand or the charging of extortionate prices on the other.

Fourth. Fix a permanent tax of a few cents per ton to be paid into a territorial fund to defray the expenses of proper supervision of mining methods under laws to be enacted by the territorial legislature, to protect the lives and health of the miners, and to provide a laborers' compensation fund.

Such a law would preserve the principles necessary to secure competition, a wide distribution of ownership, and enable the operator of moderate means to finance his enterprise, and provide for the welfare of the miners.

Fifth. The coal-land law of May 28, 1908, was intended to restrict the amount of coal land any company might own or control and to prevent monopoly, but that law is only applicable to such lands as were located prior to the withdrawal. That act has been nullified to all intents and purposes by construction and such drastic rulings by the Land Department that no titles can be issued under it.

Opinion on an Alaskan Railway

Falcom Joslin, of Fairbanks, Alaska, in discussing before the committee the question whether a government line should be built in Alaska for the purpose of opening up the country and developing coal mining, said:

I think the coal fields should be opened without a moment's delay. Then I believe there is no better way of getting these trunk lines built than the way proposed in the bill. You might provide that the government shall guarantee 75 per cent. of the cost of those lines by guaranteeing the bonds of a company to build them, the company to supply 25 per cent. of the cost, as was done in the western half of the Canadian line.

This is a good system. It results in the economy of private enterprise both in construction and in operation; but if the government guaranteed 75 per cent. of the cost of the lines, I would certainly put in the contract that the government should have at least 50 per cent. of the net earnings when those roads become profitable. I cannot see any reason in the world why, if the government guarantees the cost of the lines, or 75 per cent. of the cost of the lines, the government should not have a percentage of the net earnings, exactly as a banker would require for supplying the money to build them on a straight business proposition.

If I sought the money to build that line across from Seward or Cordova from a banker in New York, and he supplied the money secured by bonds to build the line, he would unquestionably require at least half of the equity or half of the stock of such company. I cannot see why, if the government is going to do such a thing, it should not have an equal privilege.

Instead of giving the government stock for its interest the government would retain a certain percentage of the net earnings when there are net earnings. As these roads could not become profitable for five, or maybe ten, years after they are built, the government would be obliged probably to pay the interest on the cost of the lines for that period. Whatever they paid on such a guarantee should be added to the cost of the roads, as the Canadians do, after seven years.

Trouble with the Coal Roads

Further progress has been made by the Department of Justice with reference to the plan for the prosecution of the coal roads along new lines as was announced by Attorney-General McReynolds some time ago. It has not, however, been positively indicated precisely how the plan will be put into effect nor does it appear that details have been fully worked out in the department.

What is evident is that the work done under the Taft administration is not considered final or conclusive. It is intended to go further and get some more effective application of the commodities clause than has yet been considered feasible. It is probable that a suit will be started against some one road rather than against several at the same time in order to make a test of the method that has been developed by Mr. McReynolds.

According to apparently trustworthy information, legislation regarding the price of coal or legislation intended to affect that price directly is not likely to be attempted during this session of Congress, but there is a disposition to await the experience of the coming fall before acting definitely upon any proposition, however limited or ineffective it may be. Neither does it appear as yet that any very good prospect exists for the adoption of an extended form of the Erdman Act intended to apply to controversies involving the transportation of coal in interstate trade.

PENNSYLVANIA

Anthracite

Hazleton—As the result of a recent decision rendered by Charles P. Neill, commissioner of labor, who has been umpire on questions submitted to him by the Conciliation Board, $500,000 in back pay will be awarded the anthracite miners who have won a victory in three or four cases

Pottsville—Five-hundred employees of the Oak Hill Colliery at Duncott, are on trike in support of eleven firemen who have struck because their demands were flatly refused by Superintendent Jeffreys.

Plymouth—Of the 49 candidates who took the mine foremen's examination in the Ninth Anthracite District, held in Plymouth, four passed successfully for mine foremen's certificates, and 14 for assistant foremen's certificates.

Bituminous

Masontown—The explosion of 500 sticks of dynamite in the magazine of the Sunshine Coal & Coke Co.'s mine No. 1, three miles from Masontown, May 10, virtually wiped out the little mining settlement, killing three men and injuring forty more. The cause of the explosion is unknown.

Monongahela—The coroner's jury which has been hearing the testimony regarding the cause of the death of 96 men in the Cincinnati mine of the Monongahela River Consolidated Coal & Coke Co., Apr. 23, has returned their verdict placing legal responsibility for the disaster upon the mine foreman, and the moral responsibility upon the mining laws of the state. Throughout the verdict blames ineffective and defective laws for the disaster, and recommends to the coal company that it operate the Cincinnati mine hereafter with safety lamps and that no machinery be used which will cause sparks. The legislature is asked to pass remedial statutes.

Uniontown—The boiler house at the Colonial No. 4 mine of the H. C. Frick Coke Co., was destroyed by fire May 10. The loss is estimated at $15,000, and 350 men will be thrown out of employment for a week. Four boilers of the structure were damaged beyond repair, and it was necessary to hire traction engines from nearby farmers to keep the mine fans running. The origin of the blaze is unknown.

MARYLAND

Cumberland—Early on the morning of May 14, 1700 lb. of dynamite and 70 kegs of powder, stored in the magazine of the Consolidation Coal Co., at Eckhart, exploded, killing three men. Every house in the town was more or less seriously damaged. The shock of the explosion was felt distinctly a distance of 60 miles.

WEST VIRGINIA

Fairmont—John Hoffer, a blacksmith by occupation, claims to have invented a mine-cage safety device which will absolutely prevent an accidental drop. He states that in a short time he is going to make a demonstration of its merits by getting into a mine cage and cutting the cable when 279 ft. from the bottom of the shaft. This demonstration, Hoffer says, will be made at the shaft of the Jamison Coal Co., at its No. 7 mine, near Barracksville. The Jamison people will be the first to equip a mine cage with this invention. If this device is what Hoffer claims, a company will be formed by local business men and it will be put upon the market.

Morgantown—Delegates to the West Virginia State Mining Institute, which meets June 24 to 26, will go to Connellsville for a trip of inspection through the H. C. Frick and Oliver & Snyder Coke Works. Mining men from all over the state will attend the institute.

Charleston—Officials of the United Mine Workers of America and the Peytona Block Coal Co. have made arrangements whereby the men working in the mines will get an advance of 7c. per ton for mining coal. This company has plenty of orders and needs 35 families at once to do work in the mines. The same arrangements have been made with the Hickory Ash Coal Co.

After more than a week of strenuous debate the Senate has referred to the education and labor committee, Senator Kern's resolution for a federal investigation of the conditions in the West Virginia coal fields. It is understood that the committee will report favorably within a few days and that the senate will adopt it.

It is understood that charges of peonage and oppression of workers in the Paint and Cabin Creek coal fields in West Virginia have been laid before Senator Kern by representatives of the State Federation of Labor and Miners Union.

OHIO

Belle Valley—The bodies of fifteen miners who lost their lives, May 17, in an explosion of firedamp at the Imperial mine have been brought to the surface by rescuers. An investigation into the cause of the explosion was begun, May 19, by officials of the State Mining Department. The Imperial mine is owned by the O'Gara Mining Co., composed principally of Cleveland stockholders.

Dilles Bottom—Three-hundred miners employed by the Rail & River Coal Co., have gone on strike, asserting that they were not getting their full weight. They claim that the screens used by the company are fitted with meshes which are too large.

Columbus—Considerable discussion is heard among coal men of the action of the Hocking Valley Ry. Co. officials in selling three thousand 30-ton coal cars to a Northwestern railroad and only securing 500 of the 60-ton cars to replace the equipment so sold. It is believed the curtailment of the railroad equipment will work a hardship on the coal trade in the summer and fall.

KENTUCKY

Louisville—One of the most interesting and practical first-aid devices seen at the first-aid meet held under the auspices of the Kentucky Mining Institute at Lexington, Ky., on May 16 and 17, was the first-aid box used by the team representing the St. Bernard Coal Mining Co., whose general offices and mines are located at Earlington, Ky. The box itself contains bandages for every possible injury, from the finger to the head and the various parts of the body, as well as safety-pins, scissors, antiseptics, aromatic spirits, distilled water, and the like. Besides the box, however, the outfit consists of adjustable splints, which can be used in the shorter lengths or bolted together for the purpose of serving in case of compound fractures. A take-down stretcher frame is also included, consisting of four sections of pipe which screw together, forming the sides, with two wooden cross pieces which complete the framework.

Spottsville—The work of pumping the water from the coal mines on Green River, which were filled during the recent flood, will start in a few days. About one-half of the men who worked at the mines previous to the flood have left the town, fearing that the mine owners could not resume work.

INDIANA

Brazil—During a severe electric storm, May 15, a coal mine belonging to Geo. Wiederoder, was struck by lightning and the tipple and sawmill near-by were burned. The total loss was $1500.

Wheatland—The mines in this vicinity are temporarily shut down because of the recent high waters.

ILLINOIS

East St. Louis—Indictments against the Vandalia, the Big Four, and the Grand Trunk Ry. of Canada and the O'Gara Coal Co., of Chicago, were returned by the United States Grand Jury for the eastern division of Illinois, is session in this city.

The five indictments include 71 counts. In the last indictments the four corporations are named as defendents, charged with conspiracy, and the maximum fine is $10,000 each on seven counts, and no minimum is named. On the remaining sixty-four counts, the maximum is $20,000 on each count, with a minimum of $1000.

MONTANA

Butte—The one hundred and fifth meeting of the American Institute of Mining Engineers will be held at Butte, Mont., from Aug. 18 to Aug. 21, 1913. Tours have been carefully arranged for members of the Institute.

UTAH

Salt Lake City—The semi-annual convention of the Rocky Mountain Coal Mining Institute will be held in Salt Lake City, June 11-13. Excursions will be made to the celebrated copper mines at Bingham. The meetings will be held in Barratt Hall and will be open to the public. It is expected that 500 delegates will be present.

FOREIGN NEWS

Beuthen, Germany—The strike of 60,000 coal miners in this district which began Apr. 21, has been called off by the Men's Trade Union, owing to the apparent hopelessness of attaining success. The employers have refused to grant the concessions which were demanded.

PERSONALS

John Gibson, formerly superintendent of the Boswell mine of the United Coal Co., has been appointed general superintendent of a mine of that company.

William Warner, for some years secretary-treasurer of the Pittsburgh District Mine Workers organization, has recently been appointed superintendent of the mines of the United Coal Co., at Thayer, W. Va.

William H. Weller, secretary and treasurer of the Munro-Warrior Coal & Coke Co., has resigned his position with that company, effective June 1. Mr. Weller has held the above mentioned position for several years.

Governor Major, of Missouri, has appointed J. P. Hawkins, of Kennett, secretary of the State Bureau of Mines and Mining, to succeed George Bartholemeus, whose term has expired. The appointment is for a period of four years, at a salary of $1800.

George Watkin Evans, consulting coal-mining engineer, of Seattle, has been selected to make an examination as to the commercial possibilities of the Matanuska coal field of Alaska, for the United States Bureau of Mines. Mr. Evans left Seattle on a preliminary trip May 18.

Word has been received of the selection of U. S. Morris, formerly commercial agent for the Clinchfield Coal Corporation, as vice-president and general manager of the Superior Colliery Co., which operates mines in the Jackson field. The general offices of the concern have been removed rfom Wellston, Ohio, to 418 Hammond Bldg, Detroit. The operating offices are still located at Wellston.

NEW PUBLICATIONS

Department of the Interior—Bureau of Mines, Bulletin 62, "National Mine Rescue and First Aid Conference, Pittsburgh, Penn., Sept. 23 to 26, 1912," by Herbert N. Wilson, 74 pages.

University of Illinois—Bulletin No. 64, "Test of Reinforced Concrete Buildings under Load," by Arthur N. Talbot, and Willis A. Slater, 104 pages, 6x9 in., with 75 diagrams, figures and illustrations.

Department of the Interior—Bureau of Mines, technical paper 38, "Waste in the Production and Utiliaztion of Natural Gas and Means for their Prevention," by Ralph Arnold and Frederick G. Clapp, 29 pages.

Department of the Interior—Bureau of Mines, "Monthly statements of coal-mining accidents in the United States for January and February, 1912," compiled by Frederick W. Horton, contains 12 pages and numerous tables.

Department of the Interior—Bureau of Mines, Bulletin 55, "The Commercial Trend of the Producer Gas Power Plant in the United States," by R. H. Fernald, 92 pages, with numerous tables and diagrams and an insert map of the United States, showing a distribution of gas-producer power plants using anthracite, bituminous and lignite fuel.

CONSTRUCTION NEWS

Sheboygan, Wis.—The C. Reiss Coal Co. will complete its new coal dock with a capacity of 250,000 tons at Green Bay before the end of the year.

Wilkes-Barre, Penn.—Bore holes are being drilled on North River St., for the foundations for the new $100,000 office building for the Lehigh Valley Coal Co.

Whitesburg, Ky.—The Lexington & Eastern is to build a branch line up Rockhouse Creek and into Knott County. It is planned to open up rich coal and timber districts.

Huntington, W. Va.—A new extension of the Baltimore & Ohio R.R., running 28 miles from Huntington, W. Va., up the left fork of Beaver Creek, is soon to tap the eastern Kentucky coal fields.

Windber, Penn.—Extensive improvements have been made by Lochrie Brothers Coal Co. at their Argentine, Butler County, plant. The daily output has been increased nearly 150 tons, and the capacity now reaches about 600 tons.

Coshocton, Ohio—Active development of the holdings of the Ohio Cannel Coal Co. in Bedford Township between Warsaw and Tunnel Hill is to be started within the next few weeks. A contract for the building of a tipple with a capacity for 5000 tons daily has been let.

Martins Ferry, Ohio—The Big Five Coal Co. has under construction eight new houses for the use of its men, employed in its Stewartsville mine. The capacity of this mine is about 1200 tons a day, and this tonnage is increasing steadily as the supply of cars is augmented.

Racine, Wis.—The Bauman & Murphy Coal Co. has decided to equip its coal-hoisting machinery with modern clamshell grabs, which will be put in operation within a week. This type of equipment lessens the time required to unload a coal barge, and reduces the number of men needed in the work.

Johnstown, Penn.—The Cambria Steel Co. has awarded contracts for 28 byproduct coke ovens, to be located at its works near Johnstown. The company proposes ultimately to increase the plant to 500 ovens, and will replace the present ovens with new ones of the byproducts type. Work on the new plant has already been commenced.

Knoxville, Iowa—Actual work of developing the New Ramsey coal shaft has been in progress since May 5, and at the present time the excavators are working in blue shale at a depth of 41 ft. The steam-hoisting apparatus is being put in place and will be in working order in a short time. The coal lies at a depth of 161 ft. and is 6 ft. 5 in. thick.

Youngstown, Ohio—Actual construction work has begun on the first ovens of the byproduct coke plant of the Republic Iron & Steel Co., at Youngstown, and it is hoped to have them completed and in operation by the end of the year. The plant will be of the Koppers' type, and is the first installation of this kind for the Republic company.

Milwaukee, Wis.—A $100,000 steel derrick is to be constructed by the Milwaukee Western Fuel Co. at 16th and Canal Sts. The derrick will form a span of 300 ft. and will be a twin to the coal hoist which was destroyed two years ago by the McNamara dynamiters. It will be equipped with clamshell grab, capable of carrying five tons of coal to each load.

Lebanon, Penn.—The Philadelphia & Reading Coal & Iron Co. has recently awarded a large contract for stripping a large tract of virgin anthracite at a point between St. Clair and Wadesville. The coal will be prepared for the market at the Wadesville breaker. The largest steam shovel employed in the anthracite region will be used in the stripping work.

Clarksburg, W. Va.—A new mine is being opened on the Stout Farm by the Francois Coal & Coke Co. It will be one of the largest and most modern plants in this region. Two of the four openings have already been made as far as the coal. The remaining two will be started at once. The work of constructing the tipple and power house will begin at an early date.

Indianapolis, Ind.—The Indianapolis Mortar & Fuel Co. is planning to enlarge its yardage and equipment and install modern coal-handling equipment. It has issued $50,000 in bonds, the money from which will pay for elevated coal pockets and apparatus for dumping cars and for dumping direct from the bins into wagons. A. E. Bradshaw is president of the company.

Whitesburg, Ky.—It is rumored from Wise County, Va., that the Wise Terminal R.R. is to be extended into the coal and Timber fields of Dickinson County, and that a right-of-way is now being secured. It is said that the road will make a connection with the Carolina, Clinchfield & Ohio, which is now constructing a branch to Elkhorn City. The work of construction will begin within the next two months.

Grafton, W. Va.—It is rumored that the Wionna Coal & Coke Co. intends to erect 16 new two-story residences at Coffman, and that the contracts will be let in a few days. During the early work at Coffman, about 25 houses were built along the hill east of the coal plant, and a few years ago several houses were built below the railroad west of the plant. The new buildings will be built north of the railroad, just west of the present location of the tipple and power house, and will be of frame construction.

Punxsutawney, Penn.—The Lindsey Coal Mining Co., which is opening a new operation at Ross Run, has awarded a contract to Patrick E. McGovern for the construction of a spur at a point three miles below this place to the new mine. The railroad track is to be completed during July, and the company expects to begin shipping coal before Aug. 1. It is estimated that the output will be between 500 and 600 tons a day when the mine is running full, and between 100 and 125 men will be employed. The new mine will be known as the Lindsey No. 8.

Pittsburgh, Penn.—More than 1000 new merchant coke ovens are being built by small independent companies in this region. Among them is the plant of the Poland Coke Co., which recently began to ship coke from its ovens at Dunkard Creek, Green County. This company is building 100 ovens. The Reliance Coal & Coke Co. is building 400 ovens at Denbo, Fayette County, and other small companies have 500 additional ovens under way. The majority of the new operations are located in Green County, which is rapidly developing as a coking center.

Pittsburgh, Penn.—Half a dozen working camps have already been established on the Montour R.R., which will extend from Homestead to North Star, where connections will be made with the old Montour R.R., a branch of the Pittsburgh & Lake Erie. A bridge to cross the Chartiers Creek near the Bell Tunnel is under way, and it is expected that the road will be completed in about 18 months. The road is owned by the Pittsburgh Coal Co. and will be used mainly as a coal and coke road. Passenger trains will be run, however, to meet the requirements of the State Railroad Commission.

NEW INCORPORATIONS

Little Rock, Ark.—The Sterling Anthracite Coal Co., of Clarksville; capital stock, $50,000. Sam Laser, president.

Chicago, Ill.—The Pilsen Coal Co.; capital stock, $10,000. Incorporators: G. H. Ruble, M. A. Bitullo, B. B. Collins.

McAlester, Okla.—The Pascoe Coal Co.; capital stock, $2000. Incorporators. W. M. Pascoe, S. Pascoe and August Bernhardt.

Dover, Del.—The American Mining & Power Co., Inc.; capital stock, $6,000,000. Incorporators: W. B. Jones and M. M. Mays.

Covington, Ky.—The Consumers Coal & Supply Co.; capital stock, $50,000. Incorporators: Louis Fritz, S. D. Rouse and D. C. Lee.

Hazard, Ky.—The Northfork Coal Co.; capital stock, $10,000. Incorporators: C. G. Bowman, E. L. Speaks, D. G. Speaks and J. W. Speaks.

Clinton, Ind.—The West Clinton Coal Co.; capital stock, $150,000; to mine coal and other minerals, and sell the same. Directors: J. Shirkie, S. Shirkie, F. P. Hancock.

Knoxville, Tenn.—The Catrons Creek Coal Co.; capital stock, $40,000. Incorporators: J. K. Griffin, L. M. G. Baker, C. H. Baker, G. H. Gallagher and B. A. Morton.

Evansville, Ind.—The Warrick Coal Mining Co.; capital stock, $5,000,000; mining. Directors: Robert R. Hammond, L. E. Fischer, H. C. Hays, W. H. Hays and A. C. Owens.

Huntington, W. Va.—The Blackburn-Thacker Coal Co.; capital stock, $100,000; coal development. Incorporators: J. C. Miller, J. E. Biscoe, F. W. Riggs, G. F. Wallace and M. E. Brown.

Birmingham, Ala.—The Fuel Economy Co.; capital stock, $25,000; headquarters, Birmingham. W. L. Rosamond, president; C. R. Waid, vice-president; W. L. Kirkland, secretary and treasurer.

Williamson, W. Va.—The Tug Valley Coal & Land Co.; capital stock, $500,000; real estate and mineral developments. Incorporators: B. C. Goings, A. Goings, W. Bronson, S. D. Stokes and F. Meeks.

Charleston, W. Va.—The Buffalo Creek Coal & Coke Co., of Atlanta, Ga., has been admitted to do business in West Virginia and hold property in that state. The company is capitalized at $800,000.

Kingwood, W. Va.—The Cleveland-Kingwood Coal & Coke Co.; capital stock, $250,000; to develop coal lands in Preston County, W. Va. Incorporators: John Orgill, S. M. Brady, Carl Huett, T. A. Fleming and W. B. White.

INDUSTRIAL NEWS

Galesburg, Ill.—A contract for 24,000 tons of soft coal has been landed by the Spoon River Coal Co. The coal will be used in federal service.

Poteet, Tex.—The Poteet Sand & Coal Co. has recently struck a new seam of very fine coal. The discovery is said to be 6 ft. 6 in. thick.

Pittsburgh, Penn.—The Cambria Steel Co. has recently purchased the Robert H. Love tract of 324 acres of coal land in Loyalhanna Township for $50,000.

Washington, Penn.—Sixty-three acres of coal land in Snowden Township, have been sold by H. J. Davis to Chas. Braznell, of Pittsburgh, at a price of $700 an acre.

Shenandoah, Penn.—The Locust Mountain Coal Co., which is opening a new colliery at Raven Run, has received two new locomotives and a number of mine cars to start work at their new operations.

Greensburg, Penn.—The Greensburg Coal Co. has placed a contract with William B Scaife & Sons Co., Pittsburgh, Penn., for a structural steel headframe, together with a number of plate steel bins.

Montreal, Can.—The Montreal office of the Sullivan Machinery Co., hitherto located at 403 Lagauchetiere St., West, is now situated at Room 806, Shaughnessy Bldg., corner St. Paul and McGill Sts.

North Sydney, N. S.—During 1912, the Nova Scotia Steel & Coal Co. mined 841,000 tons of coal. Of this amount 256,000 tons were used by the company itself. A new seam of high quality coal has been discovered and 1500 more men will be employed to work it.

Leslie, Ark.—A 14-in. seam has been discovered in this vicinity, and it is claimed that the surface is underlaid for miles around by a solid bed of coal. A company has been organized, known as the Red River Coal & Mining Co., with a capital stock of $100,000.

Toledo, Ohio—Nine-day tests of three qualities of coal to determine which variety is most suitable for locomotives, are being conducted by the Toledo & Ohio Central and the Lake Erie & Western. The same engine crews are retained without layoffs as long as the tests continue.

Columbus, Ohio—E. W. Clark & Co. have leased about 90,000 acres of land which they owned in West Virginia, to the Huntington Development & Gas Co. It is said that a bond issue of about $2,000,000 will be made for the purpose of developing the lands and putting in pipe lines for the transmission of gas.

Montgomery, Ala.—The Blount Mountain Coal & Lime Co. will, it is reported, develop mineral lands owned by them in Blount, St. Clare and Jefferson Counties, Alabama. The company is capitalized at $2,000,000. J. C. McGinnis is general manager and Carl F. Wittichen assistant general manager.

Pittsburgh, Penn.—When the Rice's Landing Coal & Coke Co. has taken out its charter of incorporation, it will take over the Dillworth Coal Co.'s plant, which went into bankruptcy about 18 months ago. This plant is located near Brownsville, on the Monongahela River, and its mine and shipping facilities will be developed more fully.

Lexington, Ky.—During the past week 41,800 acres of Tennessee coal and timber land were sold to Messrs. J. A. Smith, Roger E. Miles and W. A. Odell, of Cleveland and New York. The consideration is said to have been $400,000. It is said that the Cleveland people are looking out for coal and timber lands in both Kentucky and Tennessee, and claim to have large sums of money to invest.

Sergent, Ky.—The H. Hardaway interests of Wise County, Va., have just transferred their 300 acres of coal and timber land holdings on Pine Creek, near the new extension of the L. & E. R.R. to the Heuser Coal Co., of Roanoke. It is said that it is the purpose of the company to start the work of development within the next few months. It is rumored that the amount of the consideration is unusually large.

Tamaqua, Penn.—The East Lehigh Colliery has recently established a record for pumping water from its mine. Several days ago a tap was made to a large body of water in an abandoned working, with the intention of pumping out the water so that the mammoth seam could be worked in the mine. Three pumps were kept continuously at work, and 1,750,000 gal. of water were hoisted out of the mines within 36 hr.

Tracy City, Tenn.—The Tennessee Consolidated Coal Co., is reported to have purchased the property of the Fren Hill Coal Co. near Fern Hill, Ky., including 600 acres of land, with the complete equipment for the operation of the mine. The output will be increased by the purchasers to 350 tons a day. The price, it is said, was in the neighborhood of $75,000. This sale was rumored some time ago, but the identity of the purchasers was not known.

Pottsville, Penn.—The Otto colliery, at Branchdale, one of the Reading's most valuable operations, recently handled a total of 703 mine cars on a single tipple at the breaker. This colliery has been in continuous operation for about 70 years. One of its main feeders is the White Ash slope, which was sunk in the year 1859, and bids fair to keep up its shipments for many years to come. The Otto colliery is one of the most modern in equipment in the anthracite region.

Shadyside, Ohio—Work is progressing rapidly at the new mine of the Geo. M. Jones Coal Co., at Wegee. Contractors, who are doing the concrete work, have been making rapid strides, and, while other mines were out of commission during the flood, either on their own account or because of scarcity of cars, work was continued in preparing this large operation. It is rumored that the concrete work is to be completed next week. Already, a number of new houses have been erected.

Pontiac, Ill.—The property of the Brady Coal Co. has been sold to Murphy, Linskey & Cashier for $4825. It is proposed to begin work immediately in overhauling the mine and to have a large force of men engaged in mining coal by next fall The mine will be equipped in accordance with all the requirements of the state mining laws so that a large force of men may be put to work. The coal is of excellent steaming quality and there has always been a ready sale for it in this vicinity.

Marquette, Mich.—The City Fuel Co., recently organized at Manistique, at a capitalization of $10,000, has taken over the coal business of the Chicago Lumber Co., leasing the warehouse, coal bins, etc., and the building known as the Ann Arbor.

The company has procured the agency for the high-grade coals that have been handled in the past by the Chicago Lumber Co. and arrangements are being made to procure the supply for the coming year.

Lisbon, Ohio—All the metal which has been used in the operation of the mining plant of the Duquesne Coal Co., at Newhouse, has been sold as junk. This includes all the iron rails, copper, brass, machinery, and everything composed of metal about the power house and mine. The Duquesne mines were abandoned by the company following the fire, which destroyed the power house several weeks ago, and the probability is that they will never again be operated. The price paid for the metal was $4000.

Fayetteville, W. Va.—It is rumored that 5361 acres of valuable coal land belonging to the Wm. Hill estate has been optioned to Chicago capitalists. The ultimate consideration is said to be in the neighborhood of $250,000. The option is for a period of 90 days, but it is expected that the Chicago men will close it before the expiration of that time. The new owners will operate the mine already under development, and will also open up other extensive mines. It is said that they now handle over 500 cars of coal per day.

Zanesville, Ohio—The Pan-American Coal Co., which is owned principally by Newark men, has taken over the properties of five large coal mines in Ohio and West Virginia. It is said that the Pan-American company will apply for a new state charter, increasing its capital stock to $500,000. It is said that the average ouput of the five or six mines will reach 8000 tons per day. The company already has contracts for furnishing coal to the Michigan Central, Père Marquette, Ann Arbor and other large railroads, besides having a large market for domestic consumption. All of the mines own and operate individual electrical equipment, and the coal is mined with the latest improved electric mining machinery.

COAL TRADE REVIEWS

GENERAL REVIEW

Business in hard coal for the current month is exceeding expectations, which were pessimistic because of the lack of snap during April. As a result there is a better feeling in the trade, but receipts continue rather small, and dealers claim they are unable to get sufficient business ahead to justify any heavy buying. However, companies are having difficulty in meeting orders on certain grades, while promises for May shipments are now difficult to obtain, and many orders for June delivery are already coming in.

In the Eastern coastwise bituminous trade the better grades are becoming steadily stronger and predictions are freely made that there will be a general shortage in these the coming fall and winter. Some large consumers are in the market, but bids for their business are scarce. Supplies in the spot market are short, due to the slow loading in Hampton Roads, and consignment coal is scarce. The labor shortage is also becoming a feature in the market. There is a better consumption, and, as a rule, a generally better tone pervades the trade, particularly on the more desirable qualities.

The Pittsburgh market continues to show increased strength with operators asking a substantial advance on new business. There are, however, rumors to the effect that this firmer tone is an artificial condition brought about by a restriction in production, so that the situation is subject to reversal should the companies open up full blast. The mines are running short of men and the car supply is a trifle tight. It is obvious that there is not sufficient coal to go around, and producers have ceased to ask for further orders. There is considerable activity in the steam grades in Ohio, due to a heavier railroad movement and an increased demand from manufacturers. The congestion at the head of the lakes has been removed, and the lake shipments are heavy. Quotations are firmer than for several months, with production steadily increasing.

A very heavy dumping, mostly on contract, occurred at Hampton Roads during the week, with the result that the congestion there has been relieved, and there is a scarcity of coal for the remaining vessels. The Southern market is weak, but would be much more so were it not for a car shortage which has had a steadying influence on the situation. This shortage of equipment seems to be general on all roads touching the coal fields, and there are no indications of any immediate improvement.

In the Middle Western market the consumers are becoming anxious to close contracts in order to protect themselves over a possible suspension in mining next April. The market remains moderately firm, particularly on the steam grades, and Eastern coals. The possibility of an acute shortage the coming fall is also a condition which is to be considered. Prices here, as in the Eastern coastwise markets, are holding unexpectedly firm.

BOSTON, MASS.

Bituminous—The market continues to improve, both on spot business and contract. Two large corporations have been in the market here this week, and there have been surprisingly few competitors for the business. Several of the larger agencies sent in regrets that they were not in a position to submit any quotations. The tonnage has not yet been awarded and it will be interesting to see to what quarter it goes. The $2.85 price for Pocahontas and New River f.o.b. Hampton Roads is firm, and there are those now who freely predict a shortage of high-grade coal next fall and winter.

Georges Creek is also in strong position. Shipments are regular and orders plentiful for that grade as well as for the better qualities from the Pennsylvania districts. Prices are hardening on all the desirable coals and the prospect is good for an even market during the summer months.

For inland shipment quotations are somewhat up from a week ago. The slower loading at Norfolk has shortened up the volume of consignment coal for sale, and there is a disposition to go slow for the present on commitments. All-rail shippers are getting coal forward rather slowly for the season, due, in part, to good business and parly to the shortage of labor in the various districts.

Anthracite receipts in May continue to be rather small, as compared with other normal years. Several of the anthracite companies have difficulty in working out the sizes the trade calls for, and the succession of miners' holidays, and all manner of interruptions to mining, have seriously cut down the supply available for New England. It is now practically impossible to secure from any of the larger companies a promise of May shipment and orders are already being set forward into June. The cool weather is creating a demand on retailers, especially for domestic coal, and with the fill-up orders that are usual in the spring there is a rather brisk trade.

Reports are that the companies shipping West have so much business in view that they will have little coal this summer and fall for delivery in this market. Tide-water New England is so largely dependent on the companies that are suitably equipped with transportation, and now that these are practically confining their output to the line and Western trade, the choice of coals is pretty well narrowed down from what it was two years ago.

Current wholesale quotations on bituminous are about as follows:

	Clearfields	Cambrias Somersets	Georges Creek	Pocahontas New River
Mines*	$1.05@1.40	$1.25@1.45	$1.67@1.77	
Philadelphia*	2.30@2.65	2.50@2.70	2.92@3.02	
New York*	2.60@2.95	2.80@3.00	3.22@3.32	
Baltimore*			2.85@2.95	
Hampton Roads*				$2.85
Providence†				$3.73@3.78
Boston†				3.78@3.90

*F.o.b. †On cars.

NEW YORK

Bituminous—The local soft-coal market continues to show a better tone. There is less coal on demurrage than is customary at this period of the year, and consumers are buying more freely because of the scare last winter. A great many of the new contracts are for much heavier tonnages, buyers frequently signing up for more than their actual requirements, in order to guarantee an adequate supply. Last year many of the operators failed to fulfill their contract obligations during the period high prices were in effect, and consumers are endeavoring to protect themselves against this contingency over the coming season; the possibility of a strike next April is also having an effect upon the situation. Quotations are becoming still stronger, but actual prices have not advanced and we continue those of last week as follows: West Virginia steam, $2.55@2.60; fair grades, Pennsylvania, $2.65@2.70; good grades of Pennsylvanias, $2.75@2.80; best Miller, Pennsylvania, $3.05@3.15; Georges Creek, $3.25@3.30.

Anthracite—The local hard-coal market is featureless. Business is continuing without any let up, but there is an entire absence of any snap to the trade. Indications are that May business will fall behind April, and, in fact, no great activity is anticipated until about the middle of August, when the demand will rapidly become insistent. The mines are working good at the present time, there being no further reports of "button strikes," and with the car supply good, the shipments are quite heavy.

Some companies report that they are ready to furnish any size in any quantity demanded, while others state that they are unable to meet requisitions for certain grades; it is clear in any event that nothing is going into storage. Rice and stove continue in the shorest supply, with pea and buckwheat the easiest. The water trade out of New York up into New England is quite heavy.

The local hard-coal market has not shown any material variation during the week, and is now quotable on approximately the following basis:

	Circular	Individual	
		Lehigh	Scranton
Broken	$4.60	$4.45	$4.50
Egg	4.85	4.80	4.85
Stove	4.85	4.80	4.85
Chestnut	5.10	4.95	5.00@5.10
Pea	3.50	3.30@3.35	3.35@3.50
Buckwheat	2.75	2.10@2.45	2.50@2.75
Rice	2.25	1.85@1.95	2.25
Barley	1.75	1.40@1.70	1.70

PHILADELPHIA, PENN.

Judging from the expressions heard, the current month thus far has exceeded the expectations. April did not start with the usual whirl and snap to business that characterizes that period, and rather pessimistic utterances were heard regarding business for May; now that the month is almost gone, there is a better feeling regarding June business. One large operating company states that their tidewater business already in hand is likely to carry them over during the month of June, but the business locally is not much to brag about. This is not meant to convey the idea that no coal is being sold, as there is a large tonnage moving, especially of the domestic sizes, with a fairly good demand for pea, but the dealers state that they do not seem to be able to accumulate sufficient ahead to warrant them in placing any extensive orders; one day's business almost cleans up what orders they have in hand.

This is the kind of business prevailing at present. Orders given in the morning are quite frequently filled in the afternoon, but at that, the dealers as a whole, characterize the situation as fairly satisfactory. The mines are all working full and the entire production of the prepared sizes is being absorbed. The independent operators are still on their good behavior, little or no reports of concessions being made. This is really one of the features of the market, and speaks well for prevailing conditions. Quotations of the individual producers heretofore have almost been a perfect index of trade conditions.

The bituminous market is still holding its own. The slack coal seems to be the only bad feature; outside of this, quotations are not reported as fluctuating, and in some coals, there is a better price being realized. As far as the demand is concerned, coal on cars seems to be as active as it has been, with a fair movement on contracts, although there is a host of the latter that have not been signed up as yet, for next year's business. The 10c. or 15c. advance is meeting with opposition, and with coal on the market at this much less, current requirements are being filled from spot offerings.

PITTSBURGH, PENN.

Bituminous—The local coal market continues strong, with operators continuing to ask an advance over the season prices on new business, though the standard market is still represented by the prices put out some time ago. The Pittsburgh district trade is undoubtedly stronger than the market in some of the more Western districts, and while superficially the demand is active and not easily satisfied, there is a theory in some quarters that this condition is due in considerable part to some of the larger operators having held back part of their tonnage in anticipation of better prices. If this is the case, there may not be as plain sailing as now presaged, as difficulty may occur in marketing the additional tonnages.

The advance in railroad fuel is being maintained by a number of interests, the advance being 5c. to 85c. for slack, $1.20 for mine-run and $1.30 for ¾-in. Shipments are increasing slightly from week to week. On new business the majority of operators are usually asking 5c. to 10c. over the regular prices on mine-run, ¾-in. and 1¼-in., but on the other hand the regular price of 90c. on slack is sometimes shaded 5c. We quote regular prices unchanged as follows: Slack, 90c.; nut and slack, $1.05; nut, $1.25; mine-run, $1.30; ¾-in., $1.40; 1¼ in., $1.55, per ton at mine, Pittsburgh district.

Connellsville Coke—Shading of the $2.25 asking price on prompt furnace coke has been less pronounced in the past ten days. The Bethlehem Steel Co. purchased about 15,000 tons, and paid $2.15 or $2.20 for the bulk of the tonnage, purchasing a little at $2.25. A 10c. cut is about the most to be expected now from $2.25. As to contract coke, there is more dickering. The New Jersey Zinc Co. has inquired for about 10,000 tons a month over the latter half of the year, and it is rumored in several quarters that the Pittsburgh Steel Co. has closed for its requirements against two blast furnaces now being completed and involving a possible consumption of about 25,000 tons a month. The rumor mentions 15,000 tons as having been covered, but this cannot be confirmed. While $2.50 is frequently mentioned on contract coke, no specific quotation is known to have been made on a bona fide inquiry, the $2.50 price merely representing the idea of a group of operators. We quote: Prompt furnace, $2.15@2.25; contract furnace (nominal) $2.50; prompt foundry, $2.75@3.25; contract foundry, $3@3.25 per ton at ovens.

BALTIMORE, MD.

The demand for the better grades of fuel continues good and prices remain firm. The output of most of the mines is going on contracts, and operators say that the supply for the spot market is short. In some instances, the best free steaming coal is difficult to obtain, especially Quemahoning. Some operators are not disposed to sell more than one car to spot purchasers. There is about 10c. difference in the price of spot and contract business, better grades of Georges Creek coal under contract bringing $1.60, while spot delivery is around $1.50. Georges Creek and Quemahoning coals are practically out of the spot market being contracted up for about as much as the mines are producing. Spot prices for the last-named fuels were quoted at $1.15, while contract prices ranged from $1.25 to $1.35, the same as last week. Gas coals are in good demand, and the shipments to the Lakes are heavy; there was no material change in prices for these grades during the week.

A reduction in the coal tonnage of the Baltimore & Ohio R.R. occurred in March, on account of the floods in Ohio and adjoining states. The total tonnage of the road for the month was 2,538,039 as against 3,173,168 tons for the same month of 1912.

BUFFALO, N. Y.

In spite of all sorts of discouraging conditions the bituminous market is good. There is not enough coal to go around and it appears to be growing scarcer daily. The price of slack which is usually the gage of the market, is much above what it was a year ago. Jobbers say that it went begging then at 65c. net, while it sells easily now on contract as high as 90c. The increase in the price of sizes is not so great, but there is no discount on the trade so long as slack sells at a good figure.

At the same time mine-run and three-quarter are at least 10c. higher than they were a year ago. There are also a good many shippers who are not asking for any more business at present. Especially is this true with Pittsburgh coal, which is going into the lake trade so freely and is so tied up in contracts, that shippers are pulling their salesmen off the road and letting the trade take care of itself. One reason for the strong market is that the mines are all short of men. The drain caused by so many men going home to the Turkish war has not been made up yet and it is not going to be right away. Cars are none too plenty also and a good many delays are caused in that way.

At the same time the condition of the coke trade is not reassuring. It has been weak for quite a long time and now the most optimistic of jobbers advise a quotation decidedly down from former figures, in fact to a basis of $4.75 for best Connellsville foundry. It is not very easy to say why the weakness exists, except that iron is not high and is crowding coke down to its level.

Bituminous quotations are strong at former figures, $2.80 for Pittsburgh lump, $2.65 for three-quarter, and $2.15 for slack. There is no consignment coal on track anywhere and everything is healthy. The anthracite trade is quiet, but very steady. Shipments by lake for the week were heavy, being 164,500 tons.

COLUMBUS, OHIO

Coal men in Ohio are having a good run of business in steam grades. This is due to increased activity among manufacturing establishments and a larger tonnage required for railroad fuel. In fact, every branch of the trade shows activity with the possible exception of the domestic sizes. Generally speaking, the market shows a good tone, and it is the belief that the year 1913 will be a prosperous one in coal circles.

One of the features of the trade is the good demand for lake tonnage. Since the boat congestion at the upper lake ports is over the vessels are running much more smoothly. The docks on the lower lakes are busy loading a heavy tonnage. The Northwest is demanding a large amount of fuel and Ohio operators are trying to supply the demand. Lake prices are 10c. higher than last year, and this aids in the lake movement; the ore trade is also good, and boats are active in both directions.

Steam tonnage is wanted by manufacturers in this territory in larger quantities than for some time. The bad effects of the flood are now passed and practically all factories are again in operation. Railroads are taking a larger tonnage since the freight movement has increased. No trouble has yet been experienced from a car shortage, but operators are looking forward to a lack of equipment in a few months.

Preparations are being made for an active domestic demand in about a month when the stocking period starts. The fact that dealers stocks are unusually low, is taken as an indication of a larger domestic movement than in years. Sales agents are busy making their connections for the domestic business.

Increases in production from all Ohio producing districts are reported during the past week. In the Pomeroy Bend district, which is waiting for the domestic trade, the output is estimated at 55 per cent. of the average and the same percentage prevails in the other domestic fields. In the Hocking

Valley the output is practically normal and the same is true of the Eastern Ohio field.

Quotations are rather firm and there is less price cutting now than for several months.

	Hocking	Pittsburgh	Pomeroy	Kanawha
Domestic lump	$1.50	.....	$1.50	$1.50
¾-inch	1.35	$1.25	1.35	1.30
Nut	1.15	.....	1.25	....
Mine-run	1.15	1.15	1.15	1.10
Nut, pea and slack	0.70	.....	0.70	0 70
Coarse slack	0.60	0.65	0.60	0.60

HAMPTON ROADS, VA.

The beginning of the past week saw some large shipments, both foreign and coastwise, over all the local piers, but tonnage to move coal has gradually decreased, and there is at the end of the week very few vessels waiting cargo. Such vessels as are now in the stream are not loaded on account of suppliers being short of coal due to the heavy loadings at the beginning of the week. Bonker business for the week has been exceptionally good at all piers. The greater portion of the cargo shipments have been on contract business, although there have been a few sales of spot cargoes. The New England market has taken practically all of the coastwise business.

To date the dumpings for the Sewalls Point piers alone will amount to over 150,000 tons, and unless tonnage now bound for this pier is delayed, it is hoped that the dumpings for the month of May will amount to considerably over 275,000 tons. Lamberts Point and Newport News are also well ahead in tonnage dumped, and it is expected that these piers also will run considerably over past records.

BIRMINGHAM, ALA.

The shortage of coal equipment in this district takes on a more serious aspect from week to week. Practically every railroad touching the coal fields is short of cars and there are no indications that any of them will be able to relieve the situation at any time in the near future.

Labor conditions are also gradually becoming more acute. A number of the smaller mines have suffered from shortage of labor during the past week and it is possible that had an ample supply of cars been furnished their outputs would not have been materially increased. A lack of equipment always causes unrest among the labor which has a habit of roaming from mine to mine when regular work is not obtainable.

LOUISVILLE, KY.

There is a noticeable shortness in the supply of cars at the present time and although not sufficient to restrict operations at the moment it is threatening to develop to larger proportions at any time. The probabilities are, however, that this feature will be eliminated by June when operations should be open in full swing and a heavy movement of domestic coal on into the northwest. The recent elimination of the 10c. differential in freights against the eastern Kentucky field as compared with the Jellico district is of course, having a stimulating effect on the movement from the former field into the North and Northwest.

Prices on the steam grades are weak, the off-qualities of pea and slack being quoted at as low as 20 and 25c. Western Kentucky nut and slack are selling at 40c., with the second-grade eastern Kentucky qualities at 50 and 55c., f.o.b. mines. The better grades from this district are not in very heavy demand, because of the plentiful supply of cheap coal and can be had at 85 to 90c. Block coal is also rather low, at $1.50 to $1.65, with block and nut at $1.45 to $1.50, depending largely upon the conditions of the sale. Indications point to still lower prices when consignment coal begins to come in and demurrage charges start accruing.

INDIANAPOLIS

There is little change in the mine situation in Indiana. Some mines are operating only two days a week but the average for all seems to be three or four. Prices hold steady. Practically no domestic coal is moving, but there is a normal demand for steam grades from the local mines.

Jobbers say they are not able to place all the orders they wish to for Eastern coals, the mines there reporting they are sold far ahead and that prices will be advanced 15c. a ton in June. That is probably the reason the wholesalers are anxious to get their orders in this month. Another reason is that the new interstate agreement will be made next spring and buyers are willing to make contracts to carry them over this uncertain period.

Retailers in the city report a satisfactory opening summer trade. More consumers than usual seem to be ready to put Eastern coal in their cellars while the price is at the low point. It is noted that some of the small coal yards that sprang up in the winter are for sale. This occurred when it was seen the weather was apparently going to continue mild and there was a chance to get coal at lower figures than had been paid when the fall trade opener at high figures, forcing a continuation of the high prices throughout the winter by the large yards.

DETROIT, MICH.

Bituminous—There seems to be a diminishing activity in the local market, notwithstanding the fact that industrial concerns are operating up to full capacity. However, there is no excess coal being shipped in. Quotations remain unchanged, and the strongest demand is for the finer sizes. The situation will probably become somewhat easier as the summer advances, but indications are that it will remain stronger than ordinarily.

The local market is quotable on about the following basis, f.o.b. mines:

	W. Va. Splint	Gas	Hocking	Cambridge	No. 8 Ohio	Pocahontas	Jackson Hill
Domestic lump	$1.50	....	$1.40	....	....	$1.70	$1.90
Egg	1.50	....	1.40	....	....	1.70	1.90
1½-in. lump	1.25	....	....	....	....	....	....
¾-in. lump	1.15	$1.15	1.10	$1.10	$1.10	....	....
Mine-run	1.05	1.05	1.00	1.00	1.00	1.25	....
Slack	0.85	0.90	0.80	0.80	0.80	Open	....

Anthracite—The movement of hard coal so far this month shows some little improvement over that of last month. The unusually cold spring has tended to stimulate the consumption. While there is no particularly active demand, the circular seems to be well maintained and there are no surplus tonnages in evidence. Some coal ordered as far back as February is only now coming in.

CHICAGO

There continues to be a strong demand for steam coal, the prevailing prices for the steam lump and mine-run being $1 and $1.15 at the mines. Screenings are selling at 80c. to 85c. for the lower grades and 85c. to 90c. for the better qualities.

Conditions in the coke trade are satisfactory, the supply of this commodity not being fully up to demand. A fair amount of smokeless coal is being received. Mine-run, chiefly, is in demand, the circular price being $1.25. An increase in orders for anthracite is being noted and the volume of business for the year is expected to be fully up to normal.

The car shortage question is again agitating dealers and operators. With the assurance that bountiful crops will be harvested this year, the opinion prevails that the railroads will not have a sufficient supply of equipment to handle an unusually large volume of business next fall. On this account many dealers are now purchasing coal for storage purposes.

Prevailing prices in Chicago are:

	Springfield	Franklin Co.	Clinton	W. Va.
Domestic lump	$1.97@2.07	$2.30@2.40	$2.27	
Egg		2.30@2.40		$3.65
Steam lump	$1.82@1.87		2.07	
Mine-run	1.77	2.20@2.30	1.97	3 30
Screenings	1.57	1.95	1.57@1.62	

Coke—Connellsville and Wise County, $5.25@5.50; by-product, egg, stove and nut, $4.55@4.75; gas house, $4.65@4.75.

MINNEAPOLIS—ST. PAUL

Business in the coal line has only been a repetition of the past two preceeding weeks. The trade has been slow and were it not for the fact that the time for writing contracts was here, very little activity would have been experienced. Prices are being maintained, far beyond expectations, even in the face of the existing sluggishness of the market. Very little all-rail coal is moving and the market during the past week has been practically free from demurrage coal. The steam trade is holding off expecting prices to weaken along about June 1 as was the case last year.

The hard-coal business is reported to be unusually quiet so far this year, with a tendency to hold off on the part of the country dealer. This is contrary to last year at this time, and it would seem that with the empty bins in the country and the advancing price of 10c. per month, the dealer is playing his hand very poorly. Conditions will not favor him any more by waiting. Prices on all grades of Illinois coals are holding steady with not much change from two weeks age. Various grades of screenings are still in demand and the price is ranging from 80c. to $1 at the mines.

ST. LOUIS, MO.

There is absolutely no change in local conditions, and country business, instead of picking up, seems to be dropping off. There is a fair movement of anthracite under way, and during the past week a small tonnage of Arkansas has been placed. There is nothing doing in coke, and it is al-

most a drug on account of a few speculators bringing it in unsold.

Among the washed coals No. 2 is just a trifle too plentiful, and Nos. 3 and 4, which have been bringing an exceptionally good price, are expected to drop. The circular of last week still prevails.

OGDEN, UTAH

The coal market throughout the entire Western territory is in a bad condition, with mines only working one or two days per week, due to the small demand for lump coal. This has caused quite a shortage of slack. The demand for nut coal has decreased, and with the mines working short time, the market is able to take care of the production. At this time last year there was quite an over-production of this grade, due to the brisk demand for lump coal.

The reduction in price on May 1 has not stimulated shipments or caused anyone to commence storing coal. This has been somewhat of a disappointment to the operators, who cannot get away from the idea that lowering the price or cutting quotations will increase shipments. At this time of the year the consumption of coal is at its lowest point, and at the same time the operator, whose output is large enough to dictate prices, sees fit to sell his coal at the lowest price.

SPOKANE, WASH.

A coal war has been precipitated here because mining companies are selling direct to large business blocks, hospitals and other large consumers at jobbing prices, which is lowering materially the price of the product to these buyers. Whether it will become so general as to effect the buyer of one- and two-ton lots is not known at present. The trouble has grown out of the charge that the Crows Nest Pass Co. is owned largely by the same stockholders as the Great Northern Railroad and this company is chiefly responsible for the trouble. Responsibility is also laid at the doors of the McGillvary Co. and the Corbin Coal & Coke Co. The local men have appealed to officials of the Great Northern both at Seattle and St. Paul asking that the coal company be forced to change its methods, and adding the threat that they might not receive any more shipments over their lines. This threat has been carried out after learning that the railroad will not enter into the controversy, and nearly all local dealers have refused to accept coal shipped over this line.

PORTLAND, ORE.

Newcastle (Wash.) and South Prairie coals are selling here at $9 and $7 per ton, retail, respectively. They have been shipped in to replace the Black Diamond coal of which there has been very little in the local market for some time. Lignite coals retail here at from $6.50 to $8 per ton, the wholesale price to dealers being $5.25 per ton sacked and in three-ton lots. Wyoming coal is retailing for $10 per ton, and Utah brings $9.50@10 according to haul. Stocks are light for the present but receipts are quite liberal and there will be enough to fill all requirements. Although practically no Australian coal was imported here during the past year there is still some in stock. High freight rates prohibit importations for the present. Very little Wellington coal is being sold owing to its high price, and little has been shipped in since the strike at the mines.

PRODUCTION AND TRANSPORTATION STATISTICS

CHESAPEAKE & OHIO RY.

The following is a comparative statement of the coal and coke traffic over the lines of the C. & O. Ry., for March, and the nine months ending Mar. 31, 1912-13, in short tons:

	March		Nine Months			
Destination	1913	1912	1913	%	1912	%
Tidewater	328,442	487,236	2,720,022	23	3,092,449	23
East	292,410	198,472	2,032,099	15	1,671,276	13
West	700,150	805,017	6,809,347	56	8,261,891	62
Total	1,321,002	1,490,725	11,561,468		13,025,616	
Coke	32,207	22,932	227,550		170,548	
From connections						
Bituminous	71,588	20,060	494,699	4	173,950	1
Anthracite	309	3,330	9 ,138	1	29,976	1
Grand total	1,353,209	1,513,657	11,789,018	100	13,195,164	100

NORFOLK & WESTERN RY.

The following is a statement of tonnages shipped over this road from mines in West Virginia and the commercial and company coal, for the month of March, in short tons:

Field	Shipped	Tipple	Total	Commercial	Company
Pocahontas	1,003,352	16,363	1,019,715	981,120	120,031
Tug River	184,658	3,169	187,827	153,430	34,397
Thacker	238,340	8,978	247,318	177,358	69,960
Kenova	59,345	7,470	66,815	57,108	9,707
Clinch Valley	.....	....	.....	139,426	8,621
	1,485,695	35,980	1,521,675	1,508,442	242,716

Shipments of coke entirely from the Pocahontas field, were 116,219.

BALTIMORE & OHIO R.R.

The following is a comparative statement of the coal and coke movement over this road for March and the first three months of this year and last year:

	March		3 Months	
	1913	1912	1913	1912
Coal	2,538,039	3,173,168	8,091,860	8,312,570
Coke	405,220	384,094	1,215,753	1,080,427
Total	2,943,259	3,557,262	9,307,613	9,392,997

FOREIGN MARKETS

GREAT BRITAIN

The market remains firm, but quiet, there being little inquiry. Buyers are disposed to wait until after the holidays, in the hope of easier conditions. With supplies so limited after the recent stoppages, sellers show no signs of relaxing quotations either for large or small coals. The very best Cardiff large steams are now unobtainable for May loading.

Quotations are approximately as follow:

Best Welsh steam	$5.40@5.52	Best Monmouthshires	$4.80@4.92
Best seconds	5.28@5.40	Seconds	4.68@4.80
Seconds	5.04@5.28	Best Cardiff smalls	3.60@3.72
Best dry coals	5.04@5.28	Seconds	3.36@3.48

The prices for Cardiff coals are f.o.b. Cardiff, Penarth or Barry, while those for Monmouthshire descriptions are f.o.b. Newport; both exclusive of wharfage, and for cash in 30 days—less 2½%.

COAL SECURITIES

The following table gives the range of various active coal securities and dividends paid during the week ending May 17:

	Week's Range			Year's Range	
Stocks	High	Low	Last	High	Low
American Coal Products	87	87	87	87	87
American Coal Products Pref.	109½	109½	109½	109½	109½
Colorado Fuel & Iron	31½	31	31	41½	31
Colorado Fuel & Iron Pref.	....	....	155	155	150
Consolidation Coal of Maryland	102½	102½	102½	102½	102½
Lehigh Valley Coal Sales	225	210	215	....	....
Island Creek Coal, com	52	51	51	....	....
Island Creek Coal Pref.	85	84	84	....	....
Pittsburgh Coal	..	..	18	24¾	17½
Pittsburgh Coal Pref.	80¾	80¾	80¾	95	79½
Pond Creek	22½	19½	19½	23¾	19½
Reading	160¾	158¾	159½	168¾	152½
Reading 1st Pref.	91	90	90	92½	89½
Reading 2nd Pref.	..	..	89½	95	87½
Virginia Iron, Coal & Coke	43	43	43	54	43

	Closing Bid	Closing Asked	Week's Range or Last Sale		Year's Range	
Bonds						
Colo. F. & I. gen. s.f.g. 5s	96	97	95	April '13	95	90½
Colo. F. & I. gen. 6s	..	..	107½	June '12	..	..
Col. Ind. 1st & coll. 5s. gu.	78½	79½	78½	78½	78½	85
Cons. Ind. Coal Me. 1st 5s	75	80	85	June '11	..	..
Cons. Coal 1st and ref. 5s	..	94	93	Oct. '12	..	..
Gr. Riv. Coal & C. 1st g 6s	..	100	102½	April '06	..	..
K. & H. C. & C. 1st s f g 5s	..	..	98	Jan. '13	98	98
Pocah. Con. Coll. 1st s f 5s	86½	87½	87½	Mar. '13	87½	87½
St. L. Rky. Mt. & Pac. 1st 5s	76	78	76	Mar. '13	76	80
Tenn. Coal gen. 5s	100	101½	100	May '13	100	103
Birm. Div. 1st consol. 6s	101½	103½	101	April '13	101	103
Tenn. Div. 1st g 6s	..	103½	102	Feb. '13	102	102
Cah. C. M. Co. 1st g 6s	..	104	110	Jan. '09	..	..
Utah Fuel 1st g 5s	..	..	..	..	..	..
Victor Fuel 1st s f 5s	..	80	80	May '13	79½	80
Va. I. Coal & Coke 1st g 5s	93	97	93	May '13	93	98

DIVIDENDS

Delaware & Hudson—Regular quarterly of 2¼% payable June 20, to holders of record May 28.

Hocking Valley—Regular quarterly of 1% and an extra of 4½%, payable June 28 to holders of June 6.

INDEX OF COAL LITERATURE

We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order.

BLASTING, EXPLOSIVES

Development in Explosives in the United States During the Last Three Years. Chas. E. Munroe. Eighth Internat. Cong. of App. Chem., Vol. XXV, 1912, 9⅓ pp.

Methods for the Determination of the Effective Strength of High Explosives. A. M. Coney and F. B. Holmes. Eighth Internat. Cong. of App. Chem., Vol. XXV, 1912, 16¼ pp.; illus.

Electric Dynamite Thawer. Sigurn Nauckhoff. Jernkontorets Annaler, January, 1913, 9 pp.; illus.

The Selection of Explosives Used in Engineering and Mining Operations. C. Hall and S. P. Howell. Bureau of Mines, Bull. 48, 45 pp.; illus.

Explosives in Coal Mines. (The new "permitted" list issued by the Home Office.) Coll. Guard., Apr. 18, 1913, 1½ pp. 40c.

What Dynamite Grade Markings Express. F. H. Gunsolus. Coal Age, Apr. 26, 1913, 1¼ pp. 10c.

Squibs in Mines. (Report of Departmental Committee Appointed in Nov., 1912.) Iron & Coal Trades Rev., Apr. 11, 1913, ¾ p. 40c.

The Testing of Safety Explosives. Prof. V. B. Lewis. (Abstract of paper read Apr. 2 before the Royal Soc. of Arts.) Iron Coal Trades Rev., Apr. 4, 1913, 2 pp. 40c.

Explosives and Electrical Ignition. (Sprengstoffe und elektrische Zündung.) Wichert. "Bergbau," Jan. 30, Feb. 6 and 13, 1913, 6 pp. 80c.

BORING, SHAFT-SINKING AND TUNNELING

Rand Practice in Deep Shaft-Sinking. Chas. B. Brodigan. Min. & Sci. Press, Apr. 26, May 3, 1913, 7½ pp.; illus. 40c.

BRIQUETTES

Briquette Making at Polmaise Colliery. Iron Coal Trades Rev. Apr. 4, 1913, 1⅓ pp.; illus. 40c.

The Briquetting Industry at the Head of the Lakes. Chas. T. Malcomson. The Coal Dealer, April, 1912, 3¾ pp.; illus. 20c.

Commercial Aspects of the Coal-Briquetting Industry. Chas. T. Malcolmson. Eighth Internat. Con. of App. Chem., Vol. XXV, 1912, 12½ pp.

COAL DUST

The New Coal Dust Experiments. Third report of the Explosions in Mines Committee. Iron & Coal Trades Rev., Apr. 18, 1913, 2 pp. 40c.

Small Coal and Dust; Its Production, Prevention, Treatment and Utilization (Dry Mines). J. Drummond Paton (Paper read Apr. 8 before the Manchester Geol. & Min. Soc.). Iron & Coal Trades Rev., Apr. 11, 1913, ¾ p. 40c.

The Combustion of Oxygen and Coal Dust in Mines. (Paper read Apr. 12 before North of England Inst. of Min. & Mech. Engrs.) W. C. Blackett. Iron & Coal Trades Rev., Apr. 18, 1913, ¾ p. 40c.

The Experimental Gallery Station in Derne. A detailed description of the new Westphalian outfit for explosion tests. (Die Versuchsstreckenanlage in Derne.) Beyling and Zix. Glückauf, Mar. 22, 1913, 9½ pp.; illus. 40c.

COKE

Production of Ammonium Sulphate by Means of the Sulphur in Coke Oven Gases. Coke Works Commission Report. (Ueber die Gewinnung von Ammoniumsulfat mit Hilfe des in den Kokereigasen enthaltenen Schwefels.) J. Reichel. Glückauf, Apr. 12 and 19, 1913, 7½ pp.; illus. 80c.

Types of Coke Oven Plants as Seen in Operation—II. The Gas World. Apr. 5, 1913, 5 pp.; illus. 40c.

Influence of Coke Sales on the Fuel Market. Black Diamond, Apr. 19, 1913, 1 p. 20c.

The Rise and Development of By-Product Coking—II. The Gas World. Apr. 5, 1913, 1⅓ pp. 40c.

The Advantages of the Direct Ammonia Production Process as Against the Old Indirect One. (Die Vorzüge des direkten Ammoniak-Gewinnungsverfahrens gegenüber dem alten indirekten Verfahren.) C. Heck. Glückauf, Mar. 22 and 29, 1913, 10 pp.; illus. 80c.

Latest Things in Coke Works Practice. (Die letzten Erscheinungen auf dem Gebiete des Kokereiwesens.) K. Ellingen. Feuerungstechnik, Apr. 15, 1913, 2 pp.; illus. 40c.

Carbonization in Bulk in Horizontal Chambers. G. S. Cooper. Gas World, Apr. 26, 1913, 2¼ pp.; illus. 40c.

Notes on the Recent Reconstruction of a Retort House at Deckton, Eng. (Abstract of paper by T. Goulden, read at meeting of Eastern Counties Gas Managers' Assn., Apr. 24.) Gas World, Apr. 26, 1913, 2¾ pp.; illus. 40c.

DRAINAGE, PUMPING, ETC.

A Pump Designed for Acid Water. Coal Age, Apr. 5, 1913, 1½ pp.; illus. 10c.

The Advantages of Electric Pumps. J. M. Matthews. Coal Age, Apr. 5, 1913, 2½ pp.; illus. 10c.

The Evolution of the Mine Pump. F. H. Kneeland. Coal Age, Apr. 5, 1913, 1 p. 10c.

ELECTRICITY

Hydro-Electric Power for West Virginia Industries. Mfrs. Rec., Apr. 17, 1913, 1 p.; illus. 25c.

Safeguarding the Use of Electricity in Mines. H. H. Clark. Proc. Amer. Inst. Elec. Engrs., April, 1913, 7 pp.

Purchased Power in Coal Mines. H. C. Eddy. Proc. Amer. Inst. Elec. Engrs., April, 1913, 6 pp.

Parallel Operation of Alternators. C. A. Tupper. Coal Age, Apr. 26, 1913, 1¾ pp.; illus. 10c.

The Electrification of Cannock Chase Colliery. S. P. Sopwith. Coll. Guard., Apr. 25, 1913, 1½ pp.; illus. 40c.

Central Station Power for Coal Mines. C. W. Beers. Proc. Amer. Inst. Elec. Engrs., April, 1913, 10 pp.

Characteristics of Substation Loads at the Collieries of the Lackawanna R.R. Co. H. M. Warren & A. S. Biesecker. Proc. Amer. Inst. Elec. Engrs., April, 1913, 7 pp.; illus.

EXPLOSIONS

The Bellevue Explosions, Alberta, Canada. (An account of and subsequent investigation concerning three explosions produced by sparks from falls of roofs.) J. T. Stirling and J. Cadman. Trans. Inst. Inst. of M. E., Vol. XLIV, Part 4, 16 pp.; illus.

Forecasting Barometric Changes. Coll. Engr. April, 1913, 1½ pp. 40c.

FUEL TESTING

Standardization of Coal Sampling. Iron & Coal Trades Rev., Apr. 11, 1913, 1⅓ pp. 40c.

Standardization of Coal Analysis and Sizes. Iron & Coal Trades Rev., Apr. 18, 1913, ¾ p. 40c.

Proximate Coal Analysis and Its Value in Power Plant Economy. A. R. Maujer. (Abstract of lecture before Ill. N. A. S. E. at Chicago, Jan. 15, 1913.) Coal & Coke Op., Apr. 17, 1913, 1⅓ pp. 20c.

The Rapid Determination of Ash in Coal. H. M. Ullmann and N. W. Buch. Eighth Internat. Cong. of App. Chem., Vol. XXV, 1912, 3 pp.

Report of the Sub-Committee on Standardization of Methods on Determining Water in Coals and Other Fuels and in Minerals of the International Committee on Analyses. R. Lessing, Eighth Internat. Cong. of App. Chem., Vol. XXV, 1912, 50 pp.; illus.

GENERAL

From Alabama Coal Fields to Tidewater by Barges. Mfrs. Rec., May 1, 1913, 2 pp.; illus. 25c.

Coal-Mine Accidents in the United States, 1896-1912. F. W. Horton. Bureau of Mines, Tech. Paper 48, 66 pp.

The Ethics of Organized Labor. Coal Age, Apr. 5, 1913, 1½ p. 10c.

The French Coal Market and Supply. Coal & Coke Op., Apr. 24, 1913, ¾ p. 20c.

Coal Industry of the British Empire. Iron Coal Trades Rev., Apr. 25, 1913, ½ p. 40c.

Interesting Reminiscences About British Mines and Miners. Wm. Clifford. Coal & Coke Op., Apr. 24, 1913, 1½ pp. 20c.

Mine Accidents and the Remedy. John I. Pratt. Coal & Coke Op., Apr. 3, 1913, 2½ pp. 20c.

Properties of the Four States Coal & Coke Co. (Tells how by planning ahead the Jones' interests have made ample provision for a continuous supply of their coal for more than 100 years.) Black Diamond, Apr. 19, 1913, 2 pp.; illus. 20c.

Conservation as Applied to Bituminous Coal Industry. S. A. Taylor. Eighth Internat. Cong. of App. Chem., Vol. XXVI, 1912, 6 pp.

The Economic Utilization of Natural Fuels in Austria. (Ueber die wirtschaftlichere Ausnützung der natürlichen Brenstoffe in Oesterreich.) E. Donath. Oest. Zeit. f. B. u. H., Mar. 29 and Apr. 5, 1913, 9 pp. 80c.

Mining in the Belgian Congo in 1912. Sydney H. Ball. Min. & Sci. Press, Apr. 19, 1913, 6 pp.; illus. 20c.

Entropy-Temperature and Transmission Diagrams for Air. C. R. Richards. Univ. of Ill., Bull. 63, 15 pp.; illus.

The Illinois Coal Fields. A. Bement. Coal Age, Apr. 12, 1913, 5 pp.; illus. 10c.

Standard Colors for Designating Pipes in Industrial Works. With colored plate. (Einheitsfarben zur Kennzeichnung von Rohrleitungen in industriellen Betrieben.) Glückauf, Mar. 22, 1913, 1 p. 40c.

A Successful Mine Foreman From Four View Points. (Paper read by H. La Viers before the Kentucky Min. Inst. on Dec. 9.) Coll. Engr., April, 1913, 1 p. 40c.

Recent Attempts at Utilization of Low Grade Fuels. Address at the Mining Celebration in Vienna. (Neuere Bestrebungen bei der Verwertung minderwertiger Brennstoffe.) E. Mann. Montan. Rdsch., Mar. 16, 1913, 4 pp. 40c.

Coaling Plants at Panama Canal. Coal Age, Mar. 29, 1913, 2 pp. 10c.

Pitot Tube in Gas Measurement. C. E. McQuigg. "Eng. Min. Jl.," Mar. 29, 1913, pp. 649-51, illus. 25c.

Pipes for Flushing Purposes. (Die Rohrleitungen im Spulversatzbetriebe.) H. Keckstein. "Montan. Rdsch.," Jan. 16, 1913, pp. 53-7; ill. 40c.

A Standard System for Mine and Ventilating Maps, with a colored plate of drafting sections, etc., for different materials, piping, doors, etc. (Ueber einheitliche Ausführung der Gruben- und Wetterkarten.) O. Braun. "Montan. Rdsch.," Jan. 1, 1913, pp. 5-9; ill. 40c.

GEOLOGY

The Origin of Faults in the Rhenish-Westphalian Coal Seams. (Die Entstehung der Sprünge im rheinisch-westfälischen Steinkohlengebirge.) Dr. H. Quiring. Glückauf, Mar. 29, 1913, 4 pp.; illus. 40c.

The Formation of Coal and the Industrial Production of Hydrogen. (Results of experiments by Dr. Bergius of Hanover.) Gas World, Apr. 12, 1913, 1 p. 40c.

The Geology and Paleontology of the Warwickshire Coalfield. R. D. Vernon. (Abstract of paper read before the Geological Soc. of London.) Coll. Guard., Mar. 28, Apr. 4, 1913, 4 pp. 80c.

Folding Troubles in the Bering Field. W. R. Crane. Coal Age, Apr. 12, 1913, 3 pp.; illus. 10c.

"Horsebacks" in Oliver No. 3 Mine. E. S. Moore. Coal Age, Apr. 12, 1913, 2 pp.; illus. 10c.

Investigation of the Peat Bogs and Peat Industry of Canada, 1910-11. A. Anrep. Canadian Dept. of Mines, Mines Branch, Bull. 8, 1912, 80 pp.; illus.

Original Impurities of Bering Coal. W. R. Crane. Coal Age, Mar. 22, 1913, 1¾ pp.; illus. 10c.

Mount Mulligan Coal Field. Lionel C. Ball. Geol. Surv. of Queensland, Pub. No. 237, 1912, 39 pp.; illus.

Origin of Coal and the Carboniferous Flora. (Lecture by A. R. Horwood to the Narborough Literary Soc.) "Coll. Guard," Feb. 28, 1913, p. 251. 40c.

The South-Eastern Coal Field, the Associated Rocks and the Buried Plateau. W. Boyd Dawkins. Trans. Manchester Geol. and Min. Soc., Nov. 5, 1913, 30 pp., ill.

HOISTING AND HAULAGE

Hoist Locking Device at the Rheinpreussen Mine. An automatic electrical braking system to prevent premature starting of cages. (Fördermaschinen-Sperreinrichtung auf der Zeche Rheinpreussen.) Terbeck. Glückauf, Apr. 12, 1913, 2¼ pp.; illus. 40c.

Plant Costs and Efficiency of Electrically Driven Hoists. (Anlagekosten und Wirkungsgrad bei elektrisch betriebenen Hauptschachtfördermaschinen.) Karl Meller. Glückauf, Oct. 19, 1912, 2¼ pp.; illus. 40c.

Data of the Prussian Rope Statistics for the year 1911. An extensive contribution to the question of hoisting safety. (Ergebnisse der preussischen Seilstatistik für das Jahr 1911.) E. Burklein. Glückauf, Apr. 6 and 12, 1913, 14½ pp.; illus. 80c.

Wire Ropes Applied to Mining. Sci. & Art of Min., Apr. 26, 1913, 1¼ pp.; illus. 40c.

Shaft Hoisting with Driving Pulley. (Die Schachtforderung mit Treibscheibe-Kopescheibe.) Wintermeyer. Bergbau, Apr. 10, 1913, 4 pp.; illus. 40c.

LIGHTING

Miners' Electric Lamps. Wm. Maurice. (Higher Mining Lecture delivered at University College, Nottingham, Mar. 15.) Iron Coal Trades Rev., Apr. 4, 11, 25, 1913, 5¼ pp.; illus. $1.20.

MINE FIRES

Underground Fires. (Abstract of paper read Apr. 12 before the Min. Inst. of Scotland.) H. Rowan. Iron & Coal Trades Rev., Apr. 18, 1913, ¾ p. 40c.

PREPARATION

The Buttonwood Washery in Pennsylvania. F. B. Davenport. Coal Age, Apr. 12, 1913, 3¼ pp.; illus. 10c.

RESCUE AND AMBULANCE

A Disaster with Breathing Apparatus. Caused by neglect to put on the apparatus in air slightly gaseous from a fire. (Ein Unfall mit Atmungsgeräten.) Dr. Forstmann. Glückauf, Apr. 6, 1913, 3 pp.; illus. 40c.

TIMBERING, PACKING, ETC.

Recovery of Mine Timber. J. W. Powell. Coal Age, Apr. 5, 1913, 1¼ pp.; illus. 10c.

Preservative Treatment for Mine Timbers. G. D. Crain. Fuel Mag., Apr. 2, 1913, 1½ pp. 20c.

Forestry as Related to Mining. (Paper read by F. D. Rash before the Kentucky Min. Inst. on Dec. 9.) Coll. Engr., April, 1913, 1½ pp. 40c.

Reinforced Concrete Props and Beams in Mines. (Paper by S. M. Dixon, read Mar. 27 before the Concrete Institute.) Iron Coal Trades Rev., Apr. 4, 1913, ¾ p. 40c.

Preservation of Wood and Its Importance to Mining. (Die Konservierung des Holzes und Ihre Bedeutung für den Bergbau.) T. Wolff. Zeit. d. Zent. Verb. d. Bergbau Betr. Oest., Apr. 15, 1913, 7½ pp. 40c.

SURFACE TRANSPORTATION

The Car Hauls for a Modern Tipple. F. R. Bogart. Coal Age, Apr. 26, 1913, 1 p.; illus. 10c.

WORKING OF MINERALS

Getting Anthracite Coal Storage at a Low Cost. (Description of a plant containing many economical features.) Black Diamond, Apr. May 3, 1913, 1½ pp.; illus. 20c.

Installation and Manipulation of Coal Cutters. J. McCann. (Read before the Assn of Min. Elec. Engrs.) Iron Trades Rev., Apr. 4, 1913, 1 p.; illus. 40c.

Machine Mining in Anthracite Mines. Hugh Archbald. Coll. Engr., April, 1913, 5½ pp.; illus. 40c.

Mining in the Pocahontas Field. A. H. Stow. Coal Age, Apr. 19, 1913, 6½ pp.; illus. 10c.

Machine Coal Cutting. (Ueber maschinelle Gewinnungsarbeiten.) V. Lipold. Montan. Rdsch., Mar. 16, 1913, 4 pp.; illus. 40c.

VENTILATION

The Testing of Fans: A Plea for Standardized Test Conditions. (Abstract of Paper read Apr. 12 before the Min. Inst. of Scotland). John Watson. Iron & Coal Trades Rev., Apr. 18, 1913, ¾ p.; illus. 40c.

Alternating Current Motors for the Economic Operation of Mine Fans. F. B. Crosby. Proc. Amer. Inst. Elec. Engrs., April, 1913, 12 pp.; illus.